

THE NEW (3)
Horse-Houghing Husbandry :
OR, AN
ESSAY
ON THE
PRINCIPLES
OF
Tillage *and* Vegetation.

Wherein is Shewn,
A METHOD of INTRODUCING
A Sort of
Vineyard-Culture into the *Corn-Fields*,
In Order to
INCREASE their P R O D U C T, and DIMINISH
the C O M M O N E X P E N C E,
By the U S E of
I N S T R U M E N T S lately Invented.

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®

THE NEW
FISHING TACKLE

OR, A N

E-S-A-Y

ON THE

PRINCIPLES

OF

FISHING AND VEGETATION

—————

WATER'S SURFACE

A METHOD OF INTRODUCING

A Set of

WATER-CULTURE INTO THE COTTON

PLANTATION

IN THE STATE OF MISSISSIPPI

THE COMMON FISHES

OF THE STATE

INSITUATED IN THE STATE

—————

A NEW SYSTEM

FOR THE CULTURE OF THE COTTON



THE PREFACE.



WRITING *and* PLOUGHING
are two different Talents; and he that
writes well, must have spent in his
Study that Time, which is necessary
to be spent in the Fields, by him who will be Master
of the Art of Cultivating them.

TO write then effectually of Ploughing, one
must not be qualified to write Learnedly.

SCARCE any Subject has had more of the
Ornaments of Learning bestowed on it, than Agri-
culture

culture has, by ancient and modern Writers: But a late Great Man, who was the Cicero of the Age, having perused all their Books of Husbandry, ordered them, notwithstanding their Eloquence, to be carried upon a Hand-Barrow out of his Study, and thrown into the Fire; lest others should lose their Time in Reading them, as he had done. He declared, he could not, for his Life, guess what those Authors would be at; for they treated of an Art, wherein they had formed no manner of Principles.

NOW if these learned Volumes, so elegantly written, and so little to the Purpose, have done nothing but Mischief; 'tis Time that something should be writ different from them, in both Respects.

HOW far I am capable of performing such a Task in one of these Respects, this Part of my Essay will shew; but what I have done different from them in the other of the two Respects, cannot be fairly judged of, before the Whole appears: And because some Circumstances make it uncertain, whether

The P R E F A C E.

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whether ever it may all appear publicly, I give a short Account of it now.

THE Design of the Whole is, to increase the Profit of Land, by introducing a Sort of Vineyard-Culture into the Fields.

'TIS founded upon Principles, which if they be true (for I can only say I think them so) they must be, as all Truth is, Eternal; and yet are not extant in any Author, that I can find, or hear of.

THESE Principles I have comprised under the following Heads, or Chapters.

I. Of Roots,

II. Of Leaves.

III. Of the Food of Plants.

IV. Of the Pasture of Plants.

V. Of Dung.

VI. Of Tillage.

VII. Of Houghing.

VIII. Of Weeds.

IX. Re-

IX. Remarks on the bad Husbandry that is so finely express'd in *Virgil's First Georgic*.

X. Of Drilling and Managing of Turnips, and such like Crops in the Fields for feeding of Cattle.

XI. Of Drilling and Houghing of Wheat.

XII. Of Smuttiness of Wheat.

XIII. Of the Blight of Wheat.

XIV. Of Drilling and Managing of *St. Foin*, and of every Thing that may concern it.

XV. Of *Luserne*.

And these,

I. Of Change of Species.

II. Of Change of Individuals.

III. Of Ridges.

IV. Of Ploughs.

V. Of some Differences between the Old and the New Husbandry.

THE first Nine Chapters consist of Experiments, Observations, and Arguments to prove those Principles in Theory, which seem to solve all the Phænomena

Phænomena of Vegetation necessary to be known in Agriculture.

THE next Six Chapters shew how these Principles are to be put in Practice; for however plausible they might appear in their Speculative View, I should have rejected them on account of their Novelty, if I had not seen the Truth of them fully demonstrated in the Field.

MOST of what is said in the first of these Five (now presented to the Reader) concerning Change of Species, might have been inferr'd from some of the Arguments in the Chapter of Weeds; but because the mere ipse dixit of Doctor Woodward, seems to have been of sufficient Strength to draw after him Mr. Bradley, Mr. Mortimer, and I know not how many other Writers, into his Opinion; I thought it necessary to be more full in Arguments against it; it being of ill Consequence to the Old Husbandry, by encouraging the Sloth of Farmers to neglect the due Tillage of their Land for killing of Weeds; and would render useless, that Part of our New Husbandry which destroys all Weeds; besides another
great

great Advantage his Opinion would take from us; that is, when we have found a Species of Vegetables that suits the Degrees of Heat and Moisture (which may be call'd the Climate) of a Soil, and whose Produce also suits best our Markets; we must, after one or two Crops, change it for a different Species, which suits neither our Soil or Markets so well, if we believe that every Species takes only a specifick Nourishment which is proper to that Species alone.

SOME Arguments that are but light, may weigh more with some People than others of greater Weight; and a common Farmer may reject a false Opinion sooner, when he sees it shewn to be ridiculous, than for the strongest Argument that could be brought against it.

I MUST prevent an Objection that may perhaps be brought against me, for saying, that all the Species of Plants that have been yet try'd by our Houghing Husbandry, grow every Year better without Changing. They may alledge, that our Intervals kept from being exhausted, afford every Year a Change of Soil, but, in Truth, they were
planted

planted in narrower Intervals than we use at present, and none of the Earth kept from the Roots, they all before their Maturity, being suffered to send out their Roots quite through the Intervals; yet when they had much Pasture raised by the Hough, and were robbed of none of it by Weeds, there still remained sufficient Pasture for another Crop of the same Species to succeed it the next Year: And I have at this Time, in such Intervals, a Fifth annual successive Crop of Wheat, without intermitting any Year, and without Assistance of Dung or Manure, that is stronger than any one of the four preceding Crops, or than any Wheat in all the Neighbourhood is.

A L A T E Author advises, that Dr. Woodward of Vegetation, be inserted in every Treatise of Agriculture, and I must advise the Reader to peruse him at large; because I have, by Mistake, omitted to insert some Part which I have answered; and because another material Part which I have answered and inserted, is omitted in Mr. Lowthorp's Abridgment.

CHANGE of Individuals, is when we change our Seed; but not the Species of our Crop. What relates particularly to the changing of Seed-Wheat, is, I hope, fully treated of in the Chapter of Smut-tiness, which is too long to be here repeated.

I HAVE had a wet spewy Hill of my own made dry, by only ploughing the Ridges cross its Descent, instead of ploughing them up and down; but whether a Hill be worth more than the Ground-Plot it stands on, does not concern me; therefore I should have said nothing about it, if Mr. Bradley's Arguments thereupon had not seem'd to interfere with Part of my Theory.

UNDER the Title of Ploughs, I intended to have placed the Descriptions of all my particular Instruments of Agriculture; especially of the Drill, whereon this Husbandry depends, and is impracticable without it. I should not trouble the Reader with an Account how accidentally it was discovered, were it not to shew, that the Knowledge of a Thing which seems despicable or impertinent,

inent, may unexpectedly become useful at one time or other.

WHEN I was Young, my Diversion was Musick: I had also the Curiosity to acquaint my self thoroughly with the Fabrick of every Part of my Organ; but as little thinking that ever I should take from thence, the first Rudiments of a Drill, as that I should ever have occasion of such a Machine, or practice Agriculture; for 'twas Accident, not Choice, that made me a Farmer, or rather many Accidents which could not then possibly be foreseen.

I T was my Chance afterwards to have a large Farm in Hand, which I could not well dispose of; and it being about the Time, when Plough-Servants first began to exalt their Dominion over their Masters, so that a Gentleman-Farmer was allow'd to make but little Profit of his Arable Lands; and almost all mine being of that Sort, I resolved to plant my whole Farm with St. Foin; but the Seed of it being scarce, and dear, and very little of it good, I found it would be difficult

to procure a sufficient Quantity to sow, at seven Bushels to each Acre, which were usually sown: Whereupon I began to examine whether so great a Quantity of Seed was absolutely necessary; and whether the greatest Part of the Seed sown, did not commonly miscarry, either by its Badness, or from being buried too deep, or else lying on the Ground uncovered: And I observed in several Fields of St. Foin, sown with that Proportion of Seed, that in those Parts of them, which produced the best Crop, there were (as I counted them when the Crop was taken off) but about one Plant for each square Foot of Surface; and yet the Number of Seeds in seven Bushels sown on each Acre, being calculated, amounted to One Hundred and Forty to each square Foot; and what was yet more observable, in other Parts of the same Fields, where a much less Number of Seeds had miscarried, the Crop was less. Then after I had learn'd perfectly how to distinguish good Seeds from bad, and bad, by many Trials, found, that scarce any, even of the best, would succeed, unless covered at a certain exact Depth (especially in my strong Land) and had also found the Reason of this Nicety,
I em-

I employ'd People to make Channels, and sow a very small Proportion of Seed therein, and cover it exactly.

THIS Way succeeded to my Desire, and was in Seed and Labour but a fourth Part of the Expence of the common Way, and yet the Ground was better planted.

TEN Acres being so well done, I did not doubt, but a thousand might have been as well done in the same manner; but the next Year, as soon as I began to plant, I discover'd, that these People had conspir'd to disappoint me, for the future, and never to plant a Row tolerably well again; perhaps jealous, that if a great Quantity of Land should be taken from the Plough, it might prove a Diminution of their Power; I was forc'd to dismiss my Labourers, resolving to quit my Scheme, unless I could contrive an Engine to plant St. Foin more faithfully than such Hands would do.

TO that Purpose I examin'd and compar'd all the mechanical Ideas that ever had enter'd my Imagination,

gination, and at last pitch'd upon a Groove, Tongue, and Spring in the Sound-Board of the Organ: With these, a little alter'd, and some Parts of two other Instruments as foreign to the Field as the Organ is, added to them, I compos'd my Machine: 'Twas nam'd a Drill; because when Farmers us'd to sow their Beans and Peas into Channels or Furrows, by Hand, they call'd that Action, Drilling.

IT planted that Farm much better than Hands could have done, and many hundred Acres besides; and thirty Years Experience shews, that St. Foin thus planted, brings better Crops, and lasteth longer than sown St. Foin.

THIS Drill has also been us'd almost as long in planting most Sorts of Corn for Hand-Houghing; and these last nine Years for Horse-Houghing.

THE Hough-Plough was also intended to have been describ'd here; it ploughs as deep, and as well as a common Plough, and differs but little from it; except that this has Shafts or Thills instead of Wheels, and is so contriv'd, that the Cattle that draw it,
may

may not tread upon the Rows, when they plough betwixt them.

THE four-coulter'd Plough is very useful in the Old Husbandry ; and in preparing of Land for this : I was writing Directions how to make it ; but when I found they would be imperfect without Cuts, I laid them by ; because I did not think it reasonable to be at such an Expence, on the Account of that, which is only an Improvement of a common two-wheel'd Plough, before I had describ'd the Drill, which is an Original of my own.

HOWEVER, I have taught three Ploughwrights to make these four-coulter'd Ploughs ; and tho' two of them be dead, the Survivor is so perfect a Workman, that of all he has made, not one has fail'd to perform well ; at least, I am inform'd so.

AND, I believe, a good Workman, who can make a two-wheel'd Plough to go well with one Coulter (which few can) may make this, having another by him for a Pattern.

FOUR

FOUR Things wherein the Profit of Agriculture doth principally consist, I thought proper to mention; because few People take notice of any more than one of them.

THE cheapest Tillage is (I suppose) allow'd to be that done by Oxen; especially since Servants have had the Liberty of robbing Barns to surfeit Horses with too much Corn, and to kill them too, when they have a Mind to punish their Master's Disobedience.

WE may now keep Oxen on almost any inclos'd Farm; for we can at a very small Expence, by our sort of Houghing, raise as good Cabbages and Carrots in the Field, as us'd to grow in the Garden; and with these and Turnips, Oxen will live all the Year without the Help of Meadow or Pasture Ground.

*IT may seem absurd to call our Husbandry by the Name of Horse-Houghing, when 'tis all perform'd by Oxen; but the Truth is, it had acquir'd
that*

that Name, before 'twas known, that Oxen were capable of performing it.

THEY who think the Fields can have no Advantage from being planted in Rows, would do well to try if they can persuade the Gardeners to set their Plants irregularly, and to sow all their Seeds at Random.

FOR my Part, if I knew any substantial Objection against this Husbandry it self, I would not conceal it; but I declare, I know of none such: Yet, I know, there are many Objections against its being practised by those who do not understand it, therefore I have never advised them to attempt it; but I have dissuaded them, as much as I could, against Drilling great Quantities of Wheat, before their own Practice, in small Pieces, have made them perfect in this Method, by having the Principles which are necessary to direct them in it; for as Wheat is generally the most profitable Crop, so it requires the greatest Circumspection in the Management.

FOR some other Crops, such *Directions* might be given, that would require no more but Faith to execute them ; but so many various Circumstances usually occur in the long time that Wheat ought to live, that, I think, one can give no bare *Directions* in them all, before they happen, but what may endanger the deceiving of the Person they are intended to serve, unless the Principles themselves accompany those *Directions*.

SOME, perhaps, may suppose these Principles to be very numerous and prolix, because they cannot be written as easily as *Directions* which result from them ; though, in Truth, they are not so, for a few Lines would contain them all, if they had received the Approbation of proper Judges : In the mean time, they are either so New or Paradoxical, that I cannot, without great Reluctancy, write any of them separately from the Arguments I bring to support them ; and no Man can judge so impartially in his own Cause, or of his own Arguments, as another, who is unconcerned, may. However, when they are published,
every

every Farmer, that approves them, makes them his own; and then, whether he uses or abuses them, he cannot, I hope, justly blame me for his Conduct.

'TIS objected, that this Husbandry cannot be common, by reason the Instruments, on which it depends, are heavy and troublesome to carry to a far Distance, and very few Workmen know how to make them; and therefore we must not only submit to such Price as their Conscience will set upon them, but also dispense with their Mistakes, if they be not fatal ones, or let the Drill alone, or teach new Workmen; for, 'tis said, that no other, without the Rules, can make one good Drill by another, tho' every one is positive he can; but when he has done his utmost, to imitate, or (as he thinks) to improve it, 'tis (in all that I can hear of, made by such Workmen) good for nothing.

THIS Objection will be removed, when the Drill, with its Appurtenances, shall be fully described in Cuts, well explained by a short Treatise, shewing the Manner of Making and Using it.

Then the Brass-work, which is necessary only to those who do not understand the Drill, being made in Box Wood, instead of Brass, as it was for above twenty Years, this Instrument might be had in any Place, at a very small Price. This I should have done ere now, in order to prevent the Deceit of Pretenders; but considering how imperfectly most Engines are describ'd, I resolv'd to describe the Drill effectually, or not at all: For which Purpose, a more than ordinary Number of Cuts are necessary, to shew every Part in all its Views; and Drawing and Engraving being very Chargeable, especially to one who lives far from London, I found the End of my Labour would be to take off an Expence from others, and to lay a greater upon my self; and therefore I desisted from finishing what I had begun, deferring it to some better Opportunity.

AS to the Objection concerning the Wickedness of Servants and Labourers in Husbandry, of Hedge-breakers, and of the Takers away of our Corn at Harvest, and other Product of our Land and Labour, tho' it be a Wickedness never heard of

of in any other Age or Country, it ought not to be objected against our Husbandry in particular; unless it did affect that alone.

W H A T I most apprehend, is, the Rashness of those who shall enter upon the Practice of Drilling Wheat, before they are sufficiently inform'd concerning it; for they cannot avoid being liable to many Errors. They may drill it amongst Couch-Grass, or other perennial Weeds, which cannot be extracted from the Rows of Wheat, though they may easily be taken from Rows of Turnips, and such like Crops.

T H E Y may Drill their Wheat on Land, that is full fraught with the Seeds of Poppy, and other annual Weeds that may be pull'd out of the Rows, and yet they may neglect to do it, and suffer them to ripen, which must occasion the Loss of two Wheat Crops, by saving the Expence of about one or two Shillings per Acre; which is, in Farmers Phrase, no better, Than losing a Sheep for want of a Half-penny-worth of Tar.

T H E Y

THEY may drill it at unseasonable Times, as in the Frost of Winter ; and then the Rooks will have a fair Chance, to come in for the greatest Part of it, and the rest will be in Danger of dying with Cold.

THEY may drill a greater Quantity than they have Strength of Cattle to manage ; and then the ploughing of the two last Furrows of the Ridges may not be finish'd till the Spring of the Year, which is the Season wherein the second Houghing ought to be perform'd, by throwing up to the Rows the fine Earth mellow'd by the Frost, having lain open all the Winter for that Purpose ; instead whereof these plough'd Furrows have not, perhaps, been mov'd in a Year and a half.

THEY may plant bad Seed, that will not grow, or that is foul, infected with the Smut, or of a wrong Sort of Wheat ; for every Sort doth not equally suit every Soil, nor this Husbandry : The Sort that I have found to fit every Soil that I have try'd it on, and makes the best hough'd Crop, is the White Cone ;

'tis

'tis a white-bearded Wheat, whose Straw has a Pith like a Rush ; also the Red Lammas Wheat, with white Ears, tho' it be a little dwarfish, makes a good Crop : The great Grey Cone too does well ; but the Common red-straw'd, and white-straw'd Lammas Wheat are more difficult to manage, especially on such Land as is usually subject to the Blight of Insects ; for which Reason, I cannot advise a Beginner to venture on those Sorts.

THERE is another Sort which I conjecture would exceed all other Sorts in this Husbandry ; because it is the largest of all, and requires the most Nourishment : It makes a prodigious Crop in a Garden, but is much less when sown in the Field in the common Manner. Its Ears in the Garden were the biggest I ever saw, having many smaller Ears all round the Bottoms of the great Ones, yet when sown in the Field, the Ears in general were no bigger than those of other Wheat ; 'tis bearded, but not grey. I have seen none of it these many Years, and therefore can only recommend it to be try'd by such Drillers who know where to get it.

I WOULD gladly save my Brother Drillers the Expence of weeding their Rows of Wheat before the Land has been cleans'd by Fallow or otherwise ; but this cannot be done whilst any spurious Seeds remain in it ; unless Weeds had such an Antipathy to the Drill, as the Ancients fancy'd their Herba Medica had to Iron, so that they might refuse to grow, because the Drill pass'd over them. But since 'tis so far otherwise, that Weeds will not only grow in the Rows, but also, if not taken out, receive as much Vigour from the Houghing, as the Corn will ; therefore, when Land is very subject to Weeds, that is to say, full of their Seeds and Roots, the cheapest Way of cleansing it is, to plant thereon two successive Crops of Turnips, or such other Plants, amongst which the Horse-Hough and Hand-Hough may go near to extirpate the whole Race of Weeds, both annual and perennial. In the second Year's Crop of Turnips, the Wheat may be drill'd in the Intervals before the Turnips are taken off. This I have done ; but then they ought to be spent early ; for if they should stand all the Winter, they would injure the Wheat.

BUT,

BUT, alas! where there is not Faith enough to drill Rows of Turnips so wide, as Three Foot asunder, How shall there be Faith to plant the Rows Six Foot asunder? But 'tis found, that a competent Number of Turnips, suppose Thirty-six, Forty-eight, or Sixty, drill'd on a Perch of Ground in Rows Six Foot asunder, may be brought to greater Perfection, than the same Number (be it which it will of them) can be brought on the same Perch, drill'd in Rows Three Foot asunder; tho' the wide Rows will be but about half the Expence of the narrow, and must be ill-managed, if they do not amount to the Quantity of Four Common-sow'd Crops.

MANY are prejudic'd against wide Intervals; but when that Matter shall be fully debated, they will be found to have been much in the Wrong. I call that a narrow Interval in Wheat, which is three Foot eight Inches, and that a wide one, which is four Foot eight Inches; this added Earth may be all of it well pulveriz'd, and when it is so, one Foot may have as much Vegetable Pasture in it, as

ten Foot of the same Earth unpulveriz'd; two Furrows boughs the wide, and there must be no less to hough the narrow: So that all the Difference of Expence is only the Rent of th's added Foot. Now, an Acre being Sixty-six Foot wide, and Six Hundred and Sixty long, the Quantity of added Earth is Six Hundred and Sixty square Feet; which, at the Rate of Eleven Shillings the Acre Rent, amounts to Two-pence, and no more; and I can't think a treble Row to be well-manag'd, unless it produce two Bushels of Wheat; which, at five Shillings the Bushel, is Ten Shillings. But an ignorant Farmer, who is not us'd to this Way of Reckoning, when he sees the wide Interval in the Winter or Spring, fancies there might be another Row in the Middle of it, as good as that Row; and thence computes the Difference of the wide and narrow Intervals at Ten Shillings, which is, in Truth, but Two-pence.

WHEN the Driller desires to know exactly the Quantity of his Wheat Crop, I advise him to cut a Row, or some certain Part thereof before the Reapers begin, and see it Rubb'd or Thresh'd out immediately,

diately, and calculate his Crop by that ; for tho' the necessary Waste be less in this than in other Wheat, yet the Waste may by Accident become very uncertain ; for the Ears being very large, a great Company of Leasers may (especially when Corn is dear) leave behind them less than the Owner's usual Share ; or perhaps, the Thresher may throw one Half out of the Barn in the Straw, to increase his Wages, if he threshes by the Quarter ; or to save much of his Labour, if he threshes by the Day.

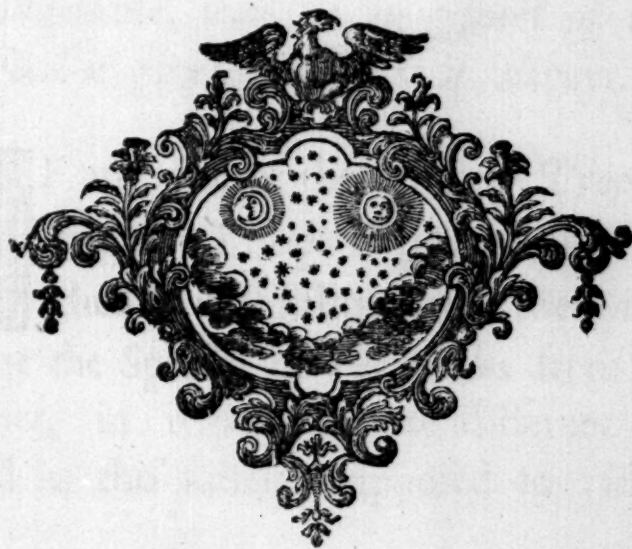
I WISH I could here give ample Directions in every Point of Management, with the Account of the whole Process of my Practice of this Husbandry ; but that cannot be expected to be done out of the proper Places. 'Tis certain, that what I now offer must needs be imperfect without the other Part ; but I could take nothing else thence, without leaving the Remainder more imperfect.

HAVING accidentally heard that Drills have been made, and sent a great Way to Strangers, who are going into this Practice, without any Experience or Knowledge of it ; I could think of no bet-

ter Way at present, to serve them and others who may do the same, than by giving them these Cautions; and assuring them, that, in my Opinion, if by any whatever Mismanagement, they fail of Success, the Fault will be imputed to the Husbandry it self; though if such Mismanagement (contrary to them) should have succeeded, it must have been an Argument against the Truth of the Principles whereon the Husbandry is founded: And that it may not be thus unjustly disparaged, nor the Well-wishers to it injured by their own Rashness, is what has induced me to publish these Papers, and my own Imperfections, I fear, too precipitately; on which Account I hope the Reader will pardon the Oversights I may have made, and also some which seem such, until further explain'd.

I NEED not say Writing is none of my Business; but I hope the Farmer will not regard the Roughness of the Stile; because he knows a Plough will go never the better for being polish'd, though much the cheaper, for not being besmear'd with Dung: Yet I must confess, that I have much less Aversion to Dung in the Field, than I have to the
Expence

Expence of Buying and Carrying it thither. And I don't doubt, but many Farmers will hate that as much as I do, when they are convinc'd by their own Experience, they can go on very well without it : And if Hopes of Profit have so much Influence on their Inclinations, as to put them upon making Trials, I wish them Success.



The P R E F A C E

It is a pleasure to have this book published. I have been very busy lately, but I have managed to find time to write a few lines. I hope you will find it interesting. I have been very busy lately, but I have managed to find time to write a few lines. I hope you will find it interesting.



T H E
New Horse-Houghing Husbandry, &c.

Of Change of SPECIES.

- I. *That Plants of the most different Nature, feed on the same Sort of Food.*
- II. *That there is no Plant but what must rob any other Plant within its Reach.*
- III. *That a Soil which is proper to one Sort of Vegetable, once, is, in respect of the Sort of Food it gives, proper to it, always.*



If any one of these *Three Propositions* be true, as I hope to prove all of them are, then it will follow, that there is no need to change the Species of *Vegetables* from one Year to another, in respect to the different Food the same Soil is, tho' falsely, supposed to yield. *

T H E

* For if all Plants rob one another, it must be because they all feed on the same Sort of Food ; and admitting they do, there can be no Necessity of changing the Species of them, from one
Soil

THE common Opinion is contrary to all these (as it must be if contrary to any one of them) and since an Error in this fundamental Principle of *Vegetation* is of very ill Consequence; and since Doctor *Woodward*, who has been serviceable in other Respects * to this Art, has unhappily fallen in with the Vulgar in this Point, his Arguments for this Error, require to be answer'd in the first Place.

THE Doctor says, † ‘ It is not possible to imagine how one uniform, homogeneous Matter having its Principles, or Original Parts all of the same Substance, Constitution, Magnitude, Figure and Gravity, should ever constitute Bodies so egregiously *unlike*, in all those Respects, as Vegetables of different Kinds are; nay, even as the different Parts of the *same* Vegetable.

Soil to another; but the same Quantity of the same Food, with the same Heat and Moisture which maintains any Species one Year, must do it any other Year.

* By proving in his Experiments, that Earth is the *Pabulum* of Plants.

† In Philos. Transf. N. 253.

‘ THAT

‘ THAT there should be that vast Difference in
‘ them, in their several Constitutions, Makes, Pro-
‘ perties, and Effects, and yet all arise from the very
‘ same Sort of Matter, would be very strange.

Answer. ’Tis very probable, that the Terres-
trial Particles which constitute *Vegetables*, tho’ in-
conceivably Minute, may be of great Variety of
Figure and other Differences, else they could not be
capable of the several Ferments, &c. they must
undergo in the Vessels of Plants. Their Smallness
can be no Objection to their Variety, since even the
Particles of Light are of various Kinds.

BUT as the Doctor asserts, ‘ That each Part of
‘ the same *Vegetable* requires a peculiar specifick
‘ Matter for its Formation and Nourishment ; and
‘ that there are very many and different Ingredients
‘ go to the Composition of the same individual
‘ Plants :

FROM hence must be inferred, that the same Plant
takes in very many and different Ingredients (and it

is proved, that no Plant refuses any Ingredient that is capable of entering its Roots.) * Tho' the Terrestrial Particles which nourish *Vegetables*, be not perfectly homogeneous, yet most of the various Tastes and Flavours of Plants are made in, and by the Vessels. †

DOCTOR *Woodward* says, ' That Water will
' pass Pores and Interstices, that neither Air, nor
' any other Fluid will ; this enables it to enter the
' finest Tubes and Vessels of Plants, and to intro-
' duce the Terrestrial Matter, conveying it to all
' Parts of them ; whilst each, by Means of Organs
' 'tis endow'd with for the Purpose, intercepts and
' assumes into it self, such Particles as are suitable to

* Dr. *Grew*, in his Anatomy of Plants by Microscopical Inspection, found, that the outer Superficies of Roots was of a spongy Substance ; and 'tis well known that no such Body can refuse to imbibe whatever Liquor comes in contact with it, but will by its springy Porosity absorb any Sort of Moisture.

† We are convinced, that 'tis the Vessels of Plants that make the different Flavour ; because there is none of these Flavours in the Earth of which they are made, until that has enter'd and been alter'd by the Vegetable Vessels.

' its

its own Nature; * letting the rest pass on *through*
the common Ducts.

HERE then he says plainly, That each Plant receives the Terrestrial Matter in Gross, both Suitable and Unsuitable in its Nature, retains the Suitable Particles for its Augment, and the Unsuitable lets pass through it. And in another Place, he says, they are exhal'd into the Atmosphere.

AND this will appear to be the true Case of Plants; and directly contradicts what he advances, in saying, ' That each Sort of Grain takes forth that peculiar Matter that is proper for its own Nourishment. First, the Wheat draws off those Particles

* If the Doctor's Plants were so nice in leaving Vegetable Matter behind quiet and undisturb'd, 'tis a wonder they would take up the Mineral Matter, as he says they did that kill'd themselves with Nitre.

These Plants might with much less Difficulty have distinguish'd the Mineral Matter from the Vegetable Matter, than they could distinguish the different Particles of Vegetable Matter from one another, and must have been very unwise to chuse out the Nitre (their Poison) from the Water and Earth, and to

‘ ticles that suit the Body of that Plant, *the rest*
 ‘ *lying all quiet and undisturb’d the while.* And
 ‘ when the Earth has yielded up all them, those
 ‘ that are proper for Barley, a different Grain, re-
 ‘ main still behind, till the successive Crops of that
 ‘ Corn fetch them forth too ; and so the Oats and
 ‘ Peas in their turn, till, in fine, all is carry’d off.

IN the former Paragraph, he says, Each Plant lets pass through it the rest of the Particles that are not

leave the Vegetable Particles behind ; none of which could be so improper to them as the Nitre.

It may, perhaps, be objected, that such like pernicious Matter kills a Plant by only destroying its Roots, and by closing the Pores which prevents the Nourishment from entering to maintain its Life ; and that such Matter doth not it self enter to act as Poison upon the Sap, or upon the Vessels of the Body, or Leaves : But it plainly appears that it doth enter, and act as Poison ; for when some of the Roots of Minth, growing in Water, are put into Salt Water, it kills the whole Plant, although the rest of the Roots remaining in the Fresh Water were sufficient to maintain it, if the other Roots had been cut off at the time they were removed into the Salt Water ; and also all the Leaves, when dead, will be full of Salt.

Or if the Juice of wild Garlick-Seed be made Use of instead of the Salt Water, it will have the same Effect ; and every one of the Minth Leaves will have a strong Taste of Garlick in it.

suitable

suitable to its own Nature. In the latter Paragraph he says, That each leaves the Unsuitable all behind for another Sort; and so on.

BOTH cannot be True.

IF the latter were True, Change of Sorts would be as necessary as it is commonly thought. But if the former be True, as I hope to prove it is, then there can be no Use of Changing of Sorts in respect of different Nourishment.

IF in this Series of Crops each Sort were so Just as to take only such Particles, as are peculiarly proper to it, letting all the rest alone to the other Sorts to which they belonged, as the Doctor imagines; then it would be equal to them all, which of the Sorts were sown first or last: But let the Wheat be sown after the Barley, Peas, and Oats, instead of being sown before them, and then it would evidently appear, by that starv'd Crop of Wheat, either that some or all of those other Grains, had violated this natural Probity, or else
that

that Nature has given to *Vegetables* no such Law of *Meum* and *Tuum*. *

IF these Things were as the Doctor affirms, why do Farmers lose a Year's Rent, and be at the Charge of Fallowing and Manuring their Land, after so few Crops; since there are many more Sorts of Grain as different from these and one another, as those are which they usually sow?

THEY still find that the first Crops are best, and the longer they continue Sowing, the worse
the

* A Charlock could not rob a Turnip, and starve it more than several Turnips can do, unless the Charlock did take from it the same Particles which would nourish a Turnip; and unless the Charlock did devour a greater Quantity of that Nourishment than several Turnips could take.

Flax, Oats, and Poppy, could not burn or waste the Soil, and make it less able to produce succeeding Crops of different Species; unless they did exhaust the same Particles, which would have nourish'd Plants of different Species: For let the Quantity of Particles, these Burners take, be never so great, the following Crops would not miss them, or suffer any Damage by the Want or Loss of them, were they not the same Particles, which would have nourish'd those Crops, if the Burners had left them behind, quiet and undisturbed. Neither could Weeds
be

the last Crops will prove, be they of never so different a Species; unless the Land were not in so good Tilt for the first Crop as for the subsequent; or unless the last sown be of a more robust Species.

THIS Matter might be easily clear'd, could we perfectly know the Nature of those supposed *unsuitable* * *Particles*, which the Doctor says pass through the common Ducts; but, in Truth, there is no more to be known of such of them, than that they are carried away by the Atmosphere to a Distance, according to the Velocity of the Air; perhaps several Miles off, at least, never like to return to the

be of any Prejudice to Corn, if they did draw off those Particles that suit the Bodies of Weeds, the rest lying all quiet and undisturb'd the while. But constant Experience shews, that all Sorts of Weeds, more or less, diminish the Crop of Corn.

* But we must not conclude, that these Particles, which pass through a Plant (though a much greater Quantity than those that abide in it for its Augment) are all unsuitable, because no one of them happens to hit upon a fit *Nidus*: For since the Life of Animals depends upon that of Plants, 'tis not unreasonable to imagine, that Nature may have provided a considerable Overplus for maintaining the Life of individual Plants, when she has provided such an innumerable Overplus for continuing every Species of Animals.

Spot

Spot of Ground from whence the Plants have raised them.

BUT suppose these cast-off Particles were, when taken in, unfit for the Nourishment of any manner of Vegetables: Then the Doctor must fancy the Wheat to be of a very scrupulous Conscience, to feed on these Particles, which were neither fit for its own Nourishment, nor of any other Plant; and at the same time to forbear to take the Food of Barley, Peas, and Oats, letting that lie still, and undisturbed the while, as he says it does, though he gives no manner of Reason for it.

'Tis needless to bring stronger Arguments, than the Doctor's Experiments afford, against his own vulgar Opinion, of Plants distinguishing the particular Sort of Terrestrial Matter, that, he says, is proper to each Sort of *Vegetable*, in these Words, *viz.* 'Each Sort takes forth that peculiar Matter that is proper for its own Nourishment, the *rest lying all quiet and undisturbed the while.*'

HE

HE says, That great Part of the Terrestrial Matter, mixed with the Water, passes up into the Plant along with it; which it could not do, if only the peculiar Matter proper to each Plant, did pass up into it: And after he has shewed how apt the *Vegetable Matter* is to attend Water in all its Motions, and to follow it into each of its Recesses; being by no Filtrations or Percolations wholly separable from it;

'TIS strange he should think that each Plant leaves the greatest Part of it behind, separated from the Water which the Plant imbibes.

THERE are, doubtless, more than a Million of Sorts of Plants, all of which, would have taken up the Water, and had each as much Right to its Share, or proper Matter in it, as the Doctor's Plants had; and then there would be but a very small (or a Millionth) Part of it proper to each of his Plants, and these leaving all the rest behind, both of the Water wherewith the Glasses at first were filled, when the Plants were put into them;

F

and

and also of all the additional Water daily supply'd into them afterwards : I say, So much more Terrestrial Matter brought into these Glasses, in Proportion to the added Water, and so very small a Part as could be proper to each of his Plants being carried off; there must have remained in these Glasses a much greater Quantity of Terrestrial Matter at the End of the Experiment, than remained in the Glasses *F* or *G*, which had no Plants in them, nor any Water added to, or diminished from them; but the quite contrary appear'd.

“ And the Water in the Glasses *F* and *G* at the
“ End of the Experiment, exhibited a larger
“ Quantity of Terrestrial Matter, than any of
“ those that had Plants in them did. The Sedi-
“ ment at the Bottom of the Glasses was greater,
“ and the *Nubiculæ* diffused thro' the Body of
“ the Water thicker.” Had the *Cataputia* insum'd with the Two Thousand Five Hundred and One Grains of Water, no more than its proper Share of the *Vegetable Matter*, it could not have attained thence an Increase of three Grains and a Quarter, nor even the thousandth Part of one Grain. But he found, “ This Terrestrial Matter, contained in
“ all

“ all Water, to be of two Kinds: The one properly, a *Vegetable Matter*, but consisting of very different Particles; some of which are proper for the Nourishment of some Kinds of Plants, others for different Sorts, &c.”

THIS, indeed, would have been a most wonderful Discovery, and might have given us a great Light, if he had told us in what Language and Character these proper Differences were stamp'd or written upon the *Vegetable Particles*; which Particles themselves, he says, were scarce visible. Certainly it must be a great Art (much beyond that of Doctor *Wallis*) to decypher the Language of Plants, from invisible Characters.

DOCTOR *Woodward* seems to have had as good Eyes, and as strong an Imagination, as the Old Woman, who saw the Needle upon the Barn, but could not see the Barn.

I WILL, by no means, call in Question the Veracity of so learned and good a Man; and therefore

therefore am willing to believe he made this extraordinary Observation in his Sleep.

BUT that this Dream may deceive none, except such who are very fond of old Errors, there is an *Experimentum Crucis* which may convince them, *viz.* At the proper Season, tap a Birch-Tree in the Body or Boughs, and you may have thence a large Quantity of clear Liquor, very little altered from Water; and you may see that every other Species of Plants, that will grow in Water, will receive this; live, and grow in it, as well as in common Water. You may make a like Experiment by tapping other Trees, or by Water distilled from Vegetables, and you will find no Species of Plants, into which this Water will not enter, and pass through it, and nourish it too, unless it be such a Species as requires more Heat than is in Water; or unless the peculiar Vessels of that it has first passed through, have so altered the *Vegetable Particles* contained in that Water, as that it acts as Poison upon some other particular Species.

THE

THE Doctor concludes, ‘ That Water is only
‘ the *Agent* that conveys the *Vegetable Matter* to
‘ the Bodies of Plants, that introduces and distri-
‘ butes it to their several Parts for their Nourishment.
‘ That *Matter* is sluggish and inactive, and
‘ would lie eternally confin’d to its Beds of
‘ Earth, without ever advancing up into Plants,
‘ did not Water, or some like Instrument, fetch
‘ it forth, and *carry* it unto them.’

THAT Water is very capable of the Office of
a Carrier, to Plants, I think the Doctor has made
most evident; but as to the Office of such an
Agent as his Hypothesis bestows upon it, it seems
impossible to be executed by Water. For it can-
not be imagined that Water, being it self but
meer *Homogenial Matter*, void of all Degrees
of Life, should *distinguish* each Particle of *Vegeta-
ble Matter*, proper and peculiar to every different
Species of Plants, which are innumerable; and
when ’tis to act for the Wheat, to find out all the
Particles proper to that Sort of Grain, to rouse
only those particular Sluggards from their Beds of
Earth,

Earth, letting all the rest lie quiet and undisturbed the while. This *Agent* frees the Wheat Particles from their Confinement, and conveys, introduces, and distributes them, and only them, into the several Parts of the Wheat. Certainly no Mortal, except Doctor *Woodward*, can pretend to distinguish the Particles of *Vegetable Matter* by any Characters, Hieroglyphicks, or other manner whatever, so as to determine to what Species, or Class of Plants, they are severally proper and peculiar; neither is it probable, that any Botanist is acquainted with half the distinct Species of *Vegetables*. Yet all the *Vegetable Particles* and *Species*, must be perfectly and distinctly known by Water, before it be capable of performing such a nice Task of an *Agent*; else, when Wheat, Barley, and Oats, are all growing together, in the same Foot of Ground, with their Roots so intangled together, that no Man can possibly distinguish the one from the other, by viewing the Roots; How should this insensible *Agent* be punctual in delivering to each its own proper Particles? For, though the *Agent* had most exactly executed a Commission of disturbing the Inactivity

vity of these three Sorts of Particles only; yet, when it had fetched them forth, if it should err in the Delivery of them, and carry the Wheat-Particles to the Barley, and those of Barley to the Oats, it would be a Mistake of worse Consequence, according to the Doctor's Opinion, than that of the *London* Undertaker's, who being to inter an old Man in *Northumberland*, and a young Lady in *Cornwall*, carried the Man to *Cornwall*, and the Lady to *Northumberland*: Her Mother, for Mitigation of Grief, would not be satisfied without a last Sight of her Daughter's Corpse; but when the Coffin was opened, the Error was discovered by the indubitable Criterion of an old shrivel'd Face, with a huge grey Beard. 'Tis no real Injury to a Person deceas'd, if the Place of his Burial be mistaken; but if Water should mistake thus in the Taking up, Carrying, and Delivery of *Vegetable Particles*, all Plants would be (upon the Doctor's Hypothesis) starv'd or poison'd, and Animals could not long survive all Plants. But since all the different Species of Plants do continue to live, their Life proves, that the *Vegetable Particles* of Earth are not proper, but *common* to them all for their Nourish-

Nourishment, if these Particles are taken up, carried and introduced into the *Vegetable* Vessels by Water ; which is capable of distinguishing neither different *Vegetable Particles*, nor different *Vegetables*.

SINCE 'tis unreasonable to believe, that Water can have such extraordinary Skill in *Botany* or in *Micrography*, as to be qualified for a sufficient Agent in such an abstruse Matter, I conceive Water to be only an Instrument or Vehicle, which takes up indifferently any Particles it meets with (and is able to carry) and advances them up into the first Plant whose Roots it comes in Contact with ; and that every Plant it meets with, does accept thereof, without distinguishing any different Sorts or Properties in them, until they be so far introduc'd and advanc'd up into the *Vegetable* Vessels, that it would be in vain to distinguish them ; for whether the Terrestrial Matter, Plants imbibe with the Water, will kill or nourish them, appears by its Effects ; but which cannot be foreknown or prevented without the Help of Faculties, which Plants are not endow'd with.

MR.

MR. *Bradley* seems to have carried this Error farther than any Author ever did before; but he supports it by Affirmations only, or by such Arguments (I cannot say Reasons, for no Reason can be against any Truth) as go near to confute the very Opinion he pretends to advance by them.

HE ascribes to *Vegetables* the Sense of Taste, by which, he thinks they take such Nourishment as is most agreeable to their respective Natures, refusing the rest; and will rather starve than eat what is disagreeable to their Palate.

IN the Preface to his *Vol. I. Page 10.* of his *Husbandry and Gardening*, he says, ‘ They feed ‘ as differently as Horses do from Dogs, or Dogs ‘ from Fish.

BUT what does he mean by this Instance *Vol. I. p. 39? viz.* ‘ That Thyme, and other Aromatics, ‘ being planted near an Apricot-Tree, would destroy that Tree; helps to confirm, that every ‘ Plant does not draw exactly the same Share of ‘ Nourishment.

I BELIEVE there is no need for him to give more Instances to disprove his Assertion than this one. His Conclusion, taken by it self, is so far right, viz. ' That if the Nourishment the Earth ' afforded to the Thyme and Apricot-Tree, had ' been *divided* into two Shares, both could not ' have had them.

BUT this his Instance proves, that those Aromaticks robb'd the Apricot-Tree of so much of its Share as to starve it; and that they, tho' of so very different a Nature, did draw from the Earth the same Nourishment which the Apricot-Tree should have taken for its Support, had not the Aromaticks been too hard for it, in drawing it off for their own Maintenance.

UNLESS he believes that all the Juices of the Aromaticks were as Poison to the Apricot, and that, according to my Experiment of the Minth, mark'd (*b*), some of their Roots might discharge some kind of Moisture in dry Weather, given them by others, that had it for their Use; and that

that the Apricot Roots, mingling with them, might imbibe enough of that Liquor, altered sufficiently by their Vessels, to poison and kill the Tree.

BUT then, Where was the Tree's distinguishing Palate? Why did it not refuse this Juice, which was so disagreeable as to kill it? And as to his Notion of *Vegetables* having Palates, let us see how it agrees with what he affirms.

‘THAT ’tis the Vessels of Plants that make, by
 ‘ their Filtrations, Percolations, &c. all the dif-
 ‘ ferent Tastes and Flavours of the Matter, which
 ‘ is the Element of Plants; and that before it be
 ‘ by them so filtered, &c. it is only a Fund of
 ‘ *insipid Substance*, capable of being altered by
 ‘ such Vessels, into any Form, Colour, or
 ‘ Flavour.’

AND Vol. I. p. 38. ‘ The different Strainers,
 ‘ or Vessels of the several Plants, growing upon
 ‘ that Spot of Earth, thus impregnated with Salts,
 ‘ alter those Salts or Juices, according to the se-
 ‘ veral Figures or Dimensions of their Strainers;

‘ so that one Plant varies, in Taste and Smell,
‘ from others, tho’ all draw their Nourishment
‘ from the same Stock lodged in the Earth.’ See
Mr. *Bradley’s Palates of Plants*, and the *Insipid Substance* he allots them to distinguish the Taste
of, how they agree.

THEY must, it seems, within their own Bodies,
give the Flavour to this insipid Substance, before
their Palates can be of any Use; and even then,
’tis impossible to be of any Use, but in the man-
ner of the Dog returning to his *Vomit*.

THEY would have as much Occasion for the
Sense of Smelling, as of Taste; but, after all, of
what Use could either of the two be to Plants,
without local Motion of their Roots, which they
are so destitute of, that no Mouth of a Root can
ever remove it self from the very Point where it
was first formed, because a Root has all its Longi-
tudinal Increase at the very End; for should the
Spaces betwixt the Branchings increase in Length,
those Branches would be broken off and left be-
hind,

hind, or else drawn out of their Cavities, which must destroy the Plant.

ALL the Branches, except the foremost, would be found with their Extremities pointing towards the Stem; the contrary of which Posture they are seen to have: And if they moved backwards, that would have much the same Effect on all the Collateral Branchings to destroy them. Smell and Taste then could be of no manner of Use to *Vegetables*, if they had them; they would have no Remedy or Possibility to mend themselves from the same Mouth, removing to search out other Food, in case they had Power to dislike or refuse what was offered them.

THEREFORE, the crude Earth being their Food, simple and free from any Alterations by Vessels, remaining insipid, cannot give, neither can Plants receive, require, or make Use of, any Variety from it, as Animals do from their Diet. It would be lost upon them, and Nature would have acted in vain, to give Smell and Taste to *Vegetables*, and nothing but insipid Earth for an Object

Object of them; or to give them a charming Variety of Relish and Savour in their Food, without giving them Senses necessary to perceive or enjoy them; which would be like Light and Colours to the Blind, Sound and Musick to the Deaf; or like giving Eyes and Ears to Animals, without Light or Sound to affect them.

THE Mouths of Plants, situate in the Convex Superficies of Roots, are analogous to the Lacteals, or Mouths, in the Concave Superficies of the Intestines of Animals.

THESE spongy Superficies of Animal Guts, and Vegetable Roots, have no more Taste or Power of refusing whatever comes in Contact with them, the one than the other.

THE free open Air would be equally injurious to both; and if exposed to it, it would dry and close up the fine Orifices in Guts and Roots; therefore Nature has guarded both from it.

NATURE

NATURE has also provided for the Preservation of both Vegetables and Animals (I do not say equally) in respect of their Food, which might poison them, or might not be fit to nourish them.

THE Security of Plants (the best that can be) is their Food it self, Earth; which having been altered by no Vessels, is always safe and nourishing to them: For a Plant is never known to be poisoned by its own natural Soil, nor starved, if it were enough of it with the requisite Quantities of Heat and Moisture.

ROOTS being therefore the Guts of Plants, have no need to be guarded by Senses; and all the Parts and Passages, which serve to distinguish and prepare the Food of Animals, before it reach the Guts, are omitted in Plants, and not at all necessary to them.

BUT as the Food of most Animals is Earth, very variously charged and modified by Vegetable

or Animal Vessels, or by both, and some of it is made wholesome, some poisonous; so that if this doubtful Food should be committed to the Intestines, without Examination, as the pure unaltered Earth is to Roots, there would, in all Probability, be very few Animals living in the World, except there be any that feed on Earth at first Hand only, as Plants do.

THEREFORE, lest this Food, so much more refined than that of Plants, should, by that very Means, become a fatal Curse, instead of a Blessing, to Animals, Nature has endowed them with Smell and Taste, as Centinels, without whose Scrutiny these various uncertain Ingredients are not admitted to come where they can enter the Lacteals, and to distinguish, at a sufficient Distance, what is wholesome and friendly, from what is hurtful; for when 'tis once passed out of the Stomach into the Guts, 'tis too late to have Benefit from Emeticks; its Venom must then be imbibed by the Lacteal Mouths, and mix with the Blood, as that must mix with the Sap, which comes

comes in Contact with the Lacteals in the Superficies of Roots, Nature having left this unguarded.

YET, Plants seem to be better secured by the Salubrity and Simplicity of their Food, than Animals are by their Senses: To compensate that Inequality of Danger, Animals have Pleasure from their Senses, except some miserable Animals (and such there are) that have more Pain than Pleasure from them. But, I suppose, more Animals than Plants are poisoned; and that a poisonous Animal is less fatal to a Plant, than a poisonous Plant is to an Animal. An Instance of this I have been told, by very credible Persons, that a Man walking in a Garden, gathered a Sprig of Sage, and eat it, which soon brought upon him the Symptoms of Poison, and Death. They dug up the Root of Sage, and found a Toad under it.

SOME of the Effluvia, or Excrementitious Juices of this loathsome Animal, had passed the Vessels of that wholesome Plant, without any apparent Injury to it, though all its Strainers were not able to correct the Venom.

H

HERE

HERE I remark, that the Minth (*E*) suffered more pestiferous Effects from the Garlick, of its own Genus, than the Sage did from the Toad, though of a different Genus.

IT killed the Man, but was not strong enough to kill the Sage. This shews, that Plants have not occasion of Palates, as Animals have.

I SAY no more of Mr. *Bradley's Vegetable Palates*; I proceed to some other Arguments against the Necessity of Changing Sorts of *Vegetables*, on Account of their taking different Nourishment.

IT being sufficiently proved, That every Sort of *Vegetables* growing in the same Soil, takes, and is nourished by the same Sort of Food; it follows from hence, That the beneficial Change of Sorts of Seeds or Plants, we see in the common Husbandry, is not from the Quality of the Sorts of Food, but from other Causes; such as,

I. *Quantity*

- I. *Quantity of the Food.*
- II. *Constitution of the Plants.*
- III. *Quantity of the Tillage.*

IN Doctor Woodward's Case, upon his Hypothesis, the three Proportions of Seeds, *viz.* Barley, Oats, and Peas, might be sown all together in the same Acre of Ground, the same Year, and make three as good Crops as if sown singly in three successive Years, and his two Crops of Wheat in one Year likewise. But every Farmer can tell, that these three Proportions of Seed would not yield half the Crop together, as one would do single; and would scarce produce more than to shew what Grains were sown, and which of the Sorts were the strongest, and the most able, Robber.

THOUGH this Failure would, in Truth, be from no other Cause than want of the sufficient Quantity of Food, which those three Crops required; yet, perhaps, the Doctor might think that

all three Crops might succeed together very well, taking each its proper Nourishment, were it not for want of *Room, Air, and Sun.*

I HAVE been credibly inform'd, that on one Perch of Ground there has grown a Bushel of Corn, which is twenty Quarters to an Acre. Mr. *Houghton* relates twenty-six, and even thirty Quarters of Wheat on one Acre. There has certainly grown twelve Quarters of Barley to an Acre, throughout a whole Field: Therefore, unless a Crop exceed the least of these, or, indeed, the greatest of them (if the Relation be true) a Crop cannot fail for want of Room; for one Acre (be it of what Nature it will, as to the Soil of it) must have as much Room for a Crop to grow on, as any other Acre.

THEN there was Room for all Doctor *Woodward's* three Crops together, to produce as much as three common Crops do. Yet all these together will scarce yield one Quarter of Corn, though there is Room, at least, for twelve.

THE same *Air* and *Sun* that had Room to do their Office to Mr. *Houghton's* Acre, why should they not have Room to do the same to Doctor *Woodward's* Acre, when the three Crops growing on it at once, though pretty good ones, might require less Room than Mr. *Houghton's* Crop did?

I PERCEIVE that those Authors, who explain *Vegetation*, by saying the Earth imbibes certain Qualities from the Air, and by Specifick Qualities, and the like, do also lay a great Stress upon the *Perpendicular* Growth of *Vegetables*; seeming to fancy there is little else necessary to a good Crop, but Room.

MR. *Bradley*, in his Arguments concerning the Value of a Hill, does implicitly say as much.

BUT if they would but consider the Diameters of the Stems, with the Measure of the Surface of an Acre, they would be convinced, that many, even of Mr. *Houghton's* Crops, might stand in a perpen-

perpendicular Posture upon an Acre, and Room be left.

FOR Mr. *Houghton* calculates, that in such a prodigious Crop, there is two Inches and a half of Room to each Ear.

ONE true Cause of a Crop's Failing, is want of a Quantity of Food to maintain the Quantity of *Vegetables* which the Food should nourish.

WHEN the Quantity of Food which is sufficient for another Species (that requires less) but not for that which last grew, to grow again the next Year, then that other is beneficial to be planted after it.

THE second true Cause is from the Constitution of Plants; some require more Food than others, and some are of a stronger Make, and better able to penetrate the Earth, and forage for themselves.

THEREFORE Oats may succeed a Crop of Wheat on strong Land, with once Ploughing, when Barley will

will not ; because Barley is not so well able to penetrate as Oats, or Beans, or Peas are.

SO a Pear-Tree may succeed a Plumb-Tree, when another Plumb-Tree cannot ; because a Pear is a much stronger Tree, and grows to a much greater Bulk, so inclined to be a Giant, that 'tis hard to make it a Dwarf ; and will penetrate and force its Way thro' the unmoved Earth, where the other cannot, being of a weaker and less robust Constitution, not so well able to shift for it self.

THE Pear could penetrate Pores that the other could not. Mr. *Evelyn* says, in his Discourse of Forest-Trees, ' That a Pear will strike Root thro' ' the roughest and most impenetrable Rocks and ' Clifts of Stone it self.' He says likewise, in his *Pomona*, ' That Pears will thrive where neither ' Apple or other Fruit could in Appearance be ' expected.'

I CAN scarce think, that a large Plant takes in larger Particles than a small one for its Nourishment ; if it did, I can't believe, that the Thyme
could

could have starv'd the Apricot-Tree ; it must have left the larger Particles of Food for that Tree, which probably would have sufficed to keep it alive ; I rather think, that great and small Plants are sustain'd by the same minute Particles : For as the fine Particles of Oats will nourish an Ox, so they will nourish a *Tom-Tit*, or a *Mite*.

SOME Plants are of a hotter Constitution, and have a quicker Digestion, like Cormorants or Pigeons, devouring more greedily, and a greater Quantity of Food than those of a colder Temperature, of equal Bulk, whose Sap having a more languid Motion, in Proportion to the less Degree of Heat in it, sends off fewer Recrements, and therefore a less Supply of Food is required in their Room. This may make some Difference in the one's succeeding the other ; because the hot-constitution'd leaves not enough for its own Species to succeed again, but leaves enough for a Species of a colder Constitution to succeed it.

BUT the third and chiefest Cause of the Benefit of changing Sorts, is Quantity of *Tillage*, in Proportion to which the Food will be produced.

THE

THE true Cause why Wheat is not (especially on any strong Soil) to be sown immediately after Wheat, is, That the first Wheat standing almost a Year on the Ground, by which it must grow harder; and Wheat Seed-Time being soon after Harvest in *England*, there is not Space of Time to Till the Land so much as a Second Crop of Wheat requires.

THO' sometimes in poorer Land that is lighter, Wheat has succeeded Wheat with tolerable Success, when I have seen on very rich strong Land, the first Crop lost by being much too ridgy, and one following it immediately, quite lost by the Poverty of it, and not worth Cutting.

THIS was enough to satisfy, that the *Tillage* which was so much easier perform'd in less time, sufficed for the light Land, but not for the strong; and if the strong Land would have been brought into as good Tilth as the light, (like as in the *New Husbandry* it may) it would have produced a much better Second Crop than the light Land did.

FROM all that has been said, these may be laid down as Maxims, *viz.* That the same Quantity of *Tillage* will produce the same Quantity of Food in the same Land: *And*, That the same Quantity of Food will maintain the same Quantity of *Vegetables*.

'TIS seen, that the same Sort of Weeds which once come naturally in a Soil, if suffer'd to grow, will always prosper in Proportion to the *Tillage* and Manure bestow'd upon it, without any Change. (And so are all manner of Plants that have been yet try'd by the *New Husbandry*, seen to do).

A VINEYARD, if not Tilled, will soon decay, even in rich Ground, as may be seen in those in *France*, lying intermingled as our Lands do in Common Fields. Those Lands of Vines, which by Reason of some Law-Suit depending about the Property of them, or otherwise, lie a Year or two Untilled, produce no Grapes, send out no Shoots hardly; the Leaves look Yellow, and seem dead, in Comparison of those on each Side of them, which

which being Tilled, are full of Fruit, send out a Hundred times more Wood, and their Leaves are large and flourishing; and continue to do the same annually for Ages, if the Plough or Hough do not neglect them.

No Change of Sorts is needful in them, if the same annual Quantity of *Tillage* (which appears to provide the same annual Quantity of Food) be continued to the Vines.

BUT what in the *Vineyards* proves this Thesis most fully, is, That where they constantly Till the Low Vines with the Plough, which is almost the same with the Hough-Plough, the Stems are planted about four Foot asunder, Chequerwise; so that they plough them four Ways. When any of these Plants happen to die, new ones are immediately planted in their Room, and exactly in the Points or Angles, where the other have rotted; else, if planted out of those Angles, they would stand in the Way of the Plough. These young Vines, I say, so planted in the very Graves, as it were, of their Predecessors, Grow, Thrive, and Prosper well,

the Soil being thus constantly Tilled: And if a Plumb-Tree, or any other Plant had such *Tillage*, it might as well succeed one of its own Species, as those Vines do.

'Tis observed, that White-Thorns will not prosper set in the Gaps of a White-Thorn Hedge: But I have seen the Banks of such Gaps dug, and thrown down one Summer, and made up again, and White-Thorns there re-planted the following Winter, with good Success.

BUT note, That the annual Ploughing the Vines is more beneficial than the one Summer *Tillage* of the Banks, the Vines having it repeated to them yearly.

I HAVE by Experience and Observations, found it to be a Rule, That *Long Tap-rooted Plants*, as *Clover* and *St. Foin*, will not succeed after those of their own or any other Species of *Long Tap-Roots*, so well as after Horizontal-rooted Plants; but, on the contrary, Horizontal, will succeed those *Tap-Roots*

Roots as well or better than they will succeed Horizontal.

I CONFESS, this Observation did, for a great while, *cheat* me into the common Belief, That different Species of Plants feed on different Food; till I was delivered from that Error, by taking Notice, that those *Tap-Roots* would thrive exceedingly well after Turnips, which have also pretty long *Tap-Roots*, though Turnips never thrive well immediately after *Clover* or *St. Foin*; I found the true Cause of this Exception to that Rule, to be chiefly the different *Tillage*. *

LAND must be well Tilled for Turnips, which also are commonly Houghed; they stand scarce ever above three Quarters of a Year, and are then fed on the Ground, and then the succeeding Crop of Corn has, by that means, the Benefit of twice as much *Tillage* from the Hough as otherwise would be given to it; and the Broad

* Very mellow rich Land is so full of Vegetable Food, that 'tis an Exception to most Rules; and therefore I speak not of That.

Clover or *St. Foin*, sown with the Corn (if the Corn be not so big as to kill it) will enjoy, in its Turn, a Proportion of the extraordinary *Tillage*, and Dung of Cattle, which feed the Turnips, and thrive accordingly.

BUT Broad *Clover* and *St. Foin*, being perennial Plants, stand on the Ground so long, that it lies several Years untilld; so that Turnips, sown immediately after these, do fail, for want of their due Tillage, for which there is not sufficient Time, by ploughing often enough, because, by the common Ploughs, it requires two or three Years to make it fine enough for Turnips, or for a Repetition of Clover or *St. Foin*, in strong or swerdy Land.

ANOTHER Reason why any Crop succeeds well after Turnips (and besides their being spent on the Ground where they grow) is their cold Constitution, by which they are maintained with less Food than another Plant of the same Bulk.

THE *Parenchyma*, or fleshy Part of a Turnip, consisting of a watry Substance, which *cools* the *Vessels*, whereby the Sap's Motions is very languid, in Proportion to the very low Degree of Heat it has, and sends off its Recrements in the same Proportion likewise; and therefore requires the less of the terrene Nourishment to supply those Recrements.

THIS is seen, when a Bushel of Turnips mix'd with a Quantity of Wheaten Flour, is made into Bread, and well baked: This Bushel of Turnips gives but few Ounces Increase in Weight, more than the same Quantity of Wheaten Flour made into Bread, and baked without any Turnips. This shews there is in a Turnip very little Earth (which is the most permanent Substance of a Plant) the Oven discharges, in Vapour, near all but the largest Vessels: Its Earthy Substance being so small, is a Proof 'tis maintained by a small Quantity of Earth; and upon that Account, also of less Damage to the next Crop than another Plant would be, which required more of the solid Nourishment to constitute its firmer Body, as a Charlock does;
for

for when a Charlock comes up, contiguous to, and, at the same time, with, a Turnip, it does so rob the Turnip, that it attains not to be of the Weight of five Ounces; when a single Turnip, having no more Scope of Ground, and, in all respects (but the Vicinity of the Charlock) equal, weighs five Pounds, yet that Charlock does not weigh one Pound.

AND where three Turnips coming up, and growing thus contiguous, will weigh four Pounds; a Charlock joined with two or three Turnips, all together will be less than one Pound, upon no less Space of Ground.

THIS Observation cannot be made, except where Turnips are drill'd in Rows; and there 'tis easy to demonstrate, that a Charlock, during the time of its short Life, draws much more Earth than a Turnip of equal Bulk, from an equal Quantity of Ground. *

THE

* 'Tis certain that Turnips, when they stand for Seed, suck and impoverish the Ground exceedingly; for though they are
of

THE true Cause why *Clover* and *St. Foin* do not succeed so well after their own respective Species, or that of each other, as Corn, &c. can, is, that they take great, or greatest, Part of their Nourishment from below the Plough's Reach, so as that Under-Earth cannot be tilled deep enough, but the upper Part may be tilled deep enough for the Horizontal Roots of Corn, &c. towards which, the Rotting of the *Clover* and *St. Foin* Roots, when cut off by the Plough, do not a little contribute. And there's no doubt but that, if the Under Earth could be as well tilled for the Tap-Roots, as the Upper Earth is for the Horizontal, the Tap-Roots would succeed one another

of a cold Constitution, and consequently consume less Food than Plants of a hotter Constitution, and of the same Bulk: Yet, these Seed-Turnips being of so vast a Bulk, as sometimes eighty Quarters of their Roots go to an Acre, and their Stalks have been measured seven Foot high; and their Roots having continued at near their full Bigness for about ten Months together, and then carried off, they drain the Land more than a Crop of other Vegetables of less Bulk and a hotter Constitution, and which live a less Time; or than Wheat, which, though it lives as long, is very small, except in the four last Months.

as well as the Horizontal would succeed them, or those of their own Species, or, as the Tap-Roots do the Horizontal.

THE Under Earth, in some time, is replenished by what the Rains leave, when they sink through it; and then Tap-rooted Plants may be there nourished again, though the Upper Earth be drained by the Corn; so that no Change is so beneficial, as that betwixt Tap-rooted Plants, and those which have only Horizontal ones. The former are provided for by Rains, though not so speedily as the latter are by Tillage and Houghing.

PASTURES require no Change of Herbs; because they have annually the same Supply of Food from the Dunging of Cattle that feed on them, and from the Benefit of the Atmosphere.

MEADOWS hold out without Change of Species of Grass, though a Crop be carried off every Year; the Richness of that Soil, with the Help of the Atmosphere, Dung of Cattle in feeding the After-Crop, or else Flooding, from the overflowing
of

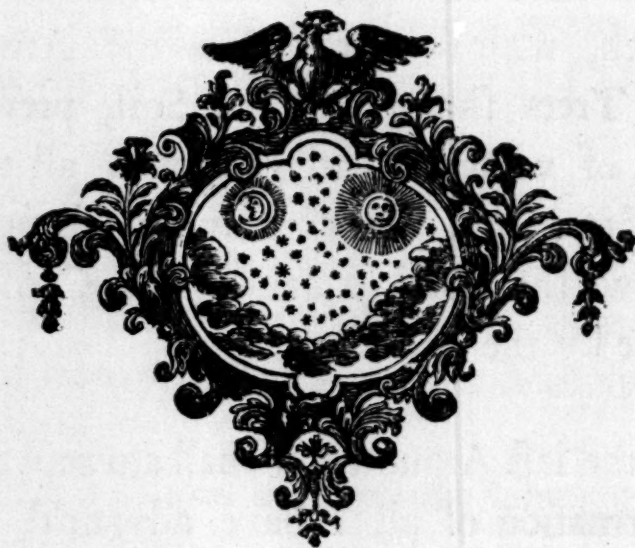
of some River, some, or all of which, supply the Place of the Plough to a Meadow.

WOODS also hold out beyond Memory or Tradition, without changing Sorts of Trees; and this, by the Leaves, and, perhaps, old Wood rotting on the Soil annually, which operates as a Manure, because, as has been said, Earth which has once passed any Vessels, is so changed, that for a long time after, it does not regain its *Homogeneity* * so much as to mix with pure Earth, without fermenting; which, with the Descent of the Atmosphere, and the Trees shadowing the Soil, prevents the Re-ascent of what that brings down; all this imitates *Tillage*, and by continually dividing the Soil, renews the Food equal to the Consumption of it made by the Wood.

AND the last Argument I shall attempt to bring for Confirmation of all I have advanc'd, is, that

* Not that the Particles of Earth are strictly *Homogeneous*, but that they are much less *Heterogeneous* before they are altered by Vessels, than afterwards.

which proves both the Truth and Use of the rest, viz. That when any Sort of *Vegetable*, by the due Degrees of Heat and Moisture it requires, is agreeable to a Soil, it may, by the *New Horse-Houghing Husbandry*, be continued without ever changing the Species.





O F

Change of *INDIVIDUALS*.

SEEDS, in their natural Climate, do not degenerate, unless Culture has improved them; and then, upon Omission of that Culture, they return to their first natural State.

As the Benefit of changing of *Species* of Seeds, is from Difference of *Tillage*, so the Benefit of changing *Individuals* of the same Species, appears to be from those Causes, which are generally, themselves, the Effects of different Climates, such as Heat and Moisture, which may also vary very much

much in the same Latitude and Neighbourhood; as the same Mountain, in the Country of the *Mogul* (related by Mr. *Evelyn*, from Monsieur *Bernier*) on the South Side produces *Indian* Plants, and on the North Side *European* Plants, from different Exposures; and some Land retaining Water longer, is colder; some suffering it to pass down quicker, and by the Nature and Figure of its Parts, causes such a Refraction, and Reflection of the Sun's Rays, which give a great Warmth, as in Sand and gravelly Grounds, that are well situate, and have an *Under-Stratum* of some Sort of hollow Matter, next under the Staple, or *Upper-Stratum*, wherein the Plough is exercised.

THIS beneficial *Change of Individuals* seems rather to be from the fore-mentioned Causes, than from Change of Food; and these Causes shew their Efficacy, chiefly in the Generation, or Foetation of those Seeds; as Flax Seed brought from *Holland*, and sown here, will bring as fine Flax as there; but the very next Generation of it *coarser*, and so degenerating gradually, after two or three Descents, becomes no better than the common ordinary

ordinary Sort; yet its Food is the same, when the Flax is fine, as when 'tis coarse.

AND so it is, when *Individuals* of Wheat are changed; so Silk Worms, hatch'd and bred in *France*, of Eggs, or Seed, brought from *Italy*, will make as fine Silk as the *Italian*; but the Eggs of these lain in *France*, and their Issue, will make no better Silk than the *French*; though their Food be from Leaves of the same Mulberry Trees, when they make fine Silks and coarse; therefore 'tis from the Climate, where the Eggs are impregnated, not where they have their Incubation, or Food when hatch'd, and fed to their Lives-End, that that this Difference happens.

COMMON Barley sown once in the burning Sand, at *Patney* in *Wiltshire*, will, for many Years after, if sown on indifferent warm Ground, be *ripe* two or three Weeks sooner than any other, which has never been impregnate at *Patney*: But if sown a Degree farther North, on cold, clayey Land, will, in two or three Years, *lose* this Quality, and become as late ripe as any other.

INDEED,

INDEED, *Patney* is far from improving the Species of Barley, except we think it improved by becoming more weak and tender, and *shorter-lived*; which last mentioned Quality fits it for such Countries, where the Summers are too short for other Barley to ripen.

THE Grains, or Seeds of *Vegetables*, are their Eggs, and the *Individual Plants*, immediately proceeding from them, have not only the Virtues they received in Embryo (or rather in *Plantulis*) but the *Diseases* also; for when smutty Wheat is sown, unless the Year prove very favourable, the Crop will be Smutty; which is an evident Token of *Mala Stamina*.

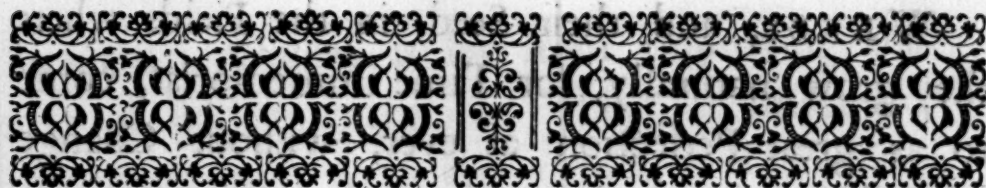
THE smutty Grains will not grow, for they turn to a black Powder; but when some of these are in a Crop, then, to be sure, many [of the rest are infected; and the Disease will shew it self in the next Generation, or Descent of it; if the Year wherein 'tis planted, prove a wet one.

WEEDS,

WEEDS, and their Seed, in the Fields where they grow naturally, for Time immemorial, come to as great Perfection as ever, without Change of Soil.

THESE Weeds, with Acorns, and other Mafts, Crabs, Sloes, Hips, and Haws, are thought to have been, originally, the natural Product of our Climate; therefore, most other Plants, being Exotics, many of them, as to their *Individuals*, require Culture, and Change of Soil, without which they are liable, more or less, to degenerate.

BUT to say, that the Soil can cause Wheat to degenerate into Rye, or convert Rye into Wheat, is what reflects upon the Credit of *Laurembergius*: 'Tis as easy to believe, that a Horse, by feeding in a certain Pasture, will degenerate into a Bull, and in other Pasture revert to a Horse again; these are scarce of more different Species than Wheat and Rye are: If the different Soil of *Wittemberg*, and *Thuringia*, change one Species, they may the other.



Of *R I D G E S*.

THE Method of ploughing Land up into *Ridges*, is a particular Sort of *Tillage*; the chief Use of which is the Alteration it makes in the Degrees of Heat and Moisture, being two of the grand Requisites of *Vegetation*; for very different Degrees of these are necessary to different Species of *Vegetables*.

THOSE *Vegetables* commonly sown in our Fields, require a middle Degree of both, not able to live on the Sides of perpendicular Walls in hot Countries, nor under Water in cold ones, neither are they amphibious, but must have a Surface of Earth
not

not cover'd, nor much soak'd with Water, which deprives them of their necessary Degree of Heat, and causes them to languish. The Symptoms of their Disease are a pale or yellow Colour in their Leaves, and a Cessation of Growth, and Death ensues as sure as from a Dropsy.

THE only Remedy to prevent this Disease in Plants, is to lay such wet Land up into *Ridges*, that the Water may run off into the Furrows, and be convey'd by Ditches or Drains into some River.

THE more a Soil is fill'd with Water, the less Heat it will have.

THE two Sorts of Land most liable to be overglutted with Water, are Hills, whereof the *Upper Stratum* (or Staple) is Mould lying upon a *Second Stratum* of Clay.

AND generally all strong deep Land.

HILLS are made wet and spewy by the Rain-Water which falls thereon, and soaks into them as

into other Land ; but being stop'd by the Clay lying next the Surface or Staple, cannot enter the Clay ; and for want of Entrance, spreads it self upon it ; and as Water naturally tends downwards, it is by the incumbent Mould partly stop'd in its Descent, from the upper, towards the lower Side of an Hill ; and being follow'd and press'd on by more Water from above, is forced to rise up into the Mould lying upon it, which it fills as a Cistern does a Fountain (or Jette d'Eau). The Land of such a Hill is not the less wet or spewy for being laid up in *Ridges*, if they be made from the higher to the lower Part of the Field ; for the Force of the Water's Weight continued, will raise it so, as to cause it to issue out at the very Tops of those *Ridges* : the Earth becomes a sort of Pap or Batter, and being like a Quagmire, in going over it, the Feet of Men and Cattle sink in till they come to the Clay ; the upper Mould is near the Condition of the *Chaos Instabilis Terra*.

THERE are two Methods of Draining such a wet Hill : The one is to dig many Trenches cross the Hill horizontally, and either fill them up with
Stones

Stones loose or Arch-wise, through which the Water, when it soaks into the Trenches, may run off at one or both Ends of them into some Ditch which is lower, and carries it away : Then they cover the Trenches with Mould, and plow over them as in dry level Ground.

THIS Method has been found effectual for a Time, but not of long Continuance ; for the Trenches are apt to be stop'd up, and then the Springs break out again as before : Besides, this is a very chargeable Work, and in many Places, the Expence of it may almost equal the Purchase of the Land.

THEREFORE, 'tis a better Method to plow the *Ridges* cross the Hill, almost horizontally, that their parting Furrows lying open, may each serve as a Drain to the *Ridge* next below it ; for when the Plough has made the Bottom of these horizontal Furrows a few Inches deeper than the Surface of the Clay, the Water will run to their Ends, very securely, without rising into the Mould, provided no Part of the Furrows be lower than their Ends.

THESE

THESE parting Furrows, and their *Ridges*, must be made more or less oblique, according to the Form and Declivity of the Hill; but the more Horizontal they are, the sooner the Rain-Water will run off the Lands; for in that Case it will run to the Furrows, and reach them at right Angles, which they will not do when the *Ridges* (or Lands) are oblique; and therefore the Water's Course cross the Lands will be longer. Every one of these horizontal Trenches receives all the Water from the Rills or little Gutters wherein the Water runs betwixt the Mould and the Clay; these are all cut off by the Trenches, which receive the Water at their upper Sides, and carry it away, as the Trunks of Lead plac'd under the Eaves of a House do carry away the Rain-Water.

IF there were no other Manner of ploughing *Ridges* on the Sides of Hills than what is commonly practised on the Plains, this Method of leaving open Furrows (or Drains on Declivities) would be impracticable; because the Plough could not turn up the Furrows against the Hill and against the
the

the *Ridge* also, from the lower Side of it: But the easy Remedy against that Inconvenience, is to plough such *Ridges* in Pairs, without throwing any Earth into the Trenches, and then the *Ridges* will be plain a-top, and the Rain-Water will run speedily downward to the next Trench, and thence to the Head-land, and so out of the Field. These Trenches will be made, as well as kept, always open by this ploughing in Pairs, and is abundantly more easy than the Way of ploughing *Ridges* singly. This ploughing in Pairs prevents also another Inconveniency which would otherwise happen to these horizontal *Ridges*; and that is, they being highest in the Middle, the Rain-Water could not run freely from the upper Half of a *Ridge* towards the next Furrow below it, but would be apt to sink in there, and sink thro' the *Ridge*; but when *Ridges* lie in Pairs, the Water will run off from a whole *Ridge*, as well as off the lower Half of a *Ridge* that is plough'd singly, and highest in the Middle.

NOTE, That every Time of Ploughing, the Pairs must be changed, so that the Furrow, which
had

had two (Lands or) *Ridges* turned towards it one time, must have two turned from it the next time: This Method keeps the Surfaces of all the *Ridges* (or Land) pretty near even, so that they may be drilled and *Horse-boughed*, either lengthways, or cross-ways. *

FARMERS are at more Trouble and Pains to drown such Land (it being common to break their Horses Wind in Ploughing up Hill) than they would be at, if they laid their *Ridges* in the abovesaid Manner, which would effectually make them dry. Many hundred Acres of good Ground are spoiled; and many a good Horse, in Ploughing against the Hill, and against all Reason, Demonstration, and Experience too, which might be learned even from the *Irish*, who drain their Bogs and make them fruitful, whilst some *English* bestow much Labour to drown and make barren many

* *Note*, This cannot be done on a Hill, whose Declivity is so great, that the Plough is not able to turn a Furrow against it. But in this Case, perhaps, it may be sufficient to plough the *Ridges* obliquely, enough for the Furrow to be turned both Ways.

of their Hills, which would more easily be made dry and fertile.

I HAVE observed, that those Places of such a Hill, that when ploughed with the Descent, were the wettest, and never produced any thing that was sown on them, became the very richest, when made dry by ploughing cross the Descent. This shews that Water does not impoverish Land, but the contrary; though, whilst it stands thereon, it prevents the Heat which is necessary to the Production of most Sorts of *Vegetables*: And where it runs swiftly, it carries much Earth away with it; where it runs slowly, it deposits, and leaves much behind it.

THOUGH, in all Places where this Way of making the *Ridges* cross the Descent of Hills is practised, the Land becomes dry, yet very few Farmers will alter their old Method; no, not even to try the Experiment; but still complain their Ground is so wet and spewy, that it brings them
M little

little or no Profit; and if the Year prove moist, they are great Losers by sowing it. *

THE Benefit of laying up strong deep Land into *Ridges*, is very great; though there be no Springs in it, as are in the Hills aforementioned.

THIS Land, when it lies flat, and is ploughed in the *Virgilian* Manner, sometimes one Way, sometimes the other, by cross Ploughing, retains the Rain-Water a long time soaking into it; by that Misfortune, the Plough is kept out two or three Weeks longer than if the same were in round *Ridges*; nay, sometimes its Flatness keeps it from drying till the Season of Ploughing, and even of Sowing too, be lost.

* Remember, in making *Ridges* of all Sorts, and of whatsoever Figure the Piece is, that no *Ridge* ought to have any more Furrows at one End, than at the other End; for if there be, the Plough must be turned in the Middle of the Piece, which will cause the Land to be trodden by the Horses; but if each End have an equal Number of Furrows, the Horses, in turning, will tread only upon the Head-Lands, which may be ploughed afterwards; or if design'd to be Horse-houghed, the Head-Lands should be narrow, and not ploughed at all.

THE

THE Reasons commonly given against such *Ridges*, are these following.

I. THEY *prevent the fancied Benefit of Cross-Ploughing.*

II. FARMERS *think they lose Part of their Ground, by leaving more Furrows betwixt Ridges, than when they lay their Land flat, where the Lands are made much larger than round Ridges can conveniently be: And because, also, the Furrows betwixt Ridges must be broader, and lie open; but the other they fill up by the Harrows.*

THE first of these I have already answered elsewhere, by shewing, that Cross-Ploughing is oftner injurious than beneficial.

THE *Second*, I shall sufficiently confute, if I can make appear that no Ground is lost, but much may be gained by *Ridges*.

WHAT I mean by gaining of Ground, is the Increasing of the Earth's Surface; for if a flat Piece be ploughed up into *Ridges*, and if in each sixteen Feet Breadth, there be an empty Furrow of two Feet; and yet by the Height and Roundness of the *Ridges*, they have eighteen Feet of Surface, capable of producing Corn equally to eighteen Feet, whilst the Piece was flat, there will be one eighth Part of profitable Ground, or Surface, gain'd more than it had when level; and this, I believe, Experience will prove, if the Thing were well examined into.

BUT against this Increase of profitable Ground, there is an Objection, which I must not call a frivolous one, in respect to the Authors who bring it; yet, I hope, the Desire of finding the Truth, will justify me to examine it, and the Arguments brought to sustain it.

THIS Opinion of theirs, is founded upon their Notion (which, I think, very erroneous) of the Pependicular Growth of *Vegetables*, and is,
by

by Mr. *Bradley*, set in its best Light, in his *Vol. I. Page 8. usque ad Page 13.* and in his Cut, representing three Hills; but his Arguments seem to be such, as all Arguments are, which pretend to prove a Thing to be what it is not, *viz.* Sophistical ones.

THE Hypothesis he endeavours to prove, is in *Page 8.* thus: “ A Hill may contain four equal
“ Sides, which meet in a Point at the Top; but
“ the Contents of these four Sides, can produce no
“ more, either of Grain or Trees, than the plain
“ Ground, upon which the Hill stands, or has its
“ Base; and yet, by the Measure of the Sides,
“ we find twice the Number of Acres, Roods;
“ and Poles, which measures in the Base, or
“ Ground Plat; and therefore, *Page 9.* Hills are
“ worth no more than half their Superficial Mea-
“ sure; *i. e.* two Acres upon the Side of the Hill
“ to pay as much as one upon the Plain, provided
“ the Soil of both is equally rich.”

TO prove it, he gives an Example in *Fig. 111.*
of Buildings upon a Hill; shewing, that the two
Sides.

Sides of the Hill will only bear the same Number of Houses, that may stand in the Line at the Base.

THIS is foreign to the Question, of how much Grain, or how many Trees, the Hill will produce. For *Vegetables* being fed by the Earth, require much more of its Surface to nourish them, than is necessary for them to stand on; but Buildings require no more of the Surface but Room to stand on: Therefore, no such Argument, taken from Buildings, can be applied to *Vegetables*.

THIS Argument of Mr. *Bradley's*, gives no more Satisfaction to the Question, about producing of *Vegetables*, than a Grazier would do, being asked, how many Oxen a certain Pasture Ground would maintain, if he should answer, by satisfying you with the Number of Churches which might stand thereon.

THE like Answer, in Effect, may be given to the Argument in *Fig. IV.* of the Pales, only he has forgot to shew, that to mound over the Hill would require double the Rails, or double the
the

the Hedge-wood (except Stakes) as to mound the Base; if it did not, the Hill would be yet of the more Value, because there more Surface might be fenced in at less Expence.

IN his *Fig. XI.* he gives no good Reason why the Hill should not bear twice the Number of Trees as the Base can do; for there is as much Room for two hundred Trees on the Hill, as for one hundred on the Base, because he allows the Surface to be double to that of the Base. He ought to measure the Distances of the Trees on the Hill, by a Line parallel to the Surface they grow on, as well as he does the Distances of those below.

AND suppose the Row at the Base, together with the Surface they grow on, were rais'd up, so that it should become parallel to Half the Row on the Hill, Would not the Trees in the Base Row be twice as near to one another as the Trees in the Hill Row are? And suppose a Line had been ty'd from the Tops of all the lower Trees before the Row was so rais'd up at one End, and then after
the

the Situation of the Row was so alter'd, if by this Line the Trees should be pull'd from being perpendicular to the Surface they grow on, and made to stand oblique to that, and perpendicular to the Horizon, as the upper Trees are, Would the Distances of the Trees from one another be alter'd by this Change of Posture? No, for their Bottoms would be at the same Distances, because not removed; and their Tops, because the same Line holds them, at the same Distances in both Postures.

MR. *Bradley's* Lines, drawn from the Trees below, which are one Perch asunder, makes the two Rows of Trees, falsely, seem to be at equal Distances, because these Lines are parallel to each other: But this is a Deceit; for, in Truth, the Distances of the Trees are not measured by the Distances of those Lines, but by the extream Points at the Ends of the Lines; * and those two Points above, where the Lines cut the Row obliquely, and at unequal Angles, are twice as far

* These upper Trees are measured by the unequal Length of the Lines, not by their Parallel Distance, as the lower Trees are; therefore his Measure is a Quibble.

asunder as the endmost or extremer Points below are, where the Lines cut the Row at Right Angles. Hence may be inferr'd, that there is Room for twice as many Trees to grow on the Hill as on the Base, and twice as much Grain for the same Reason, and because there is twice the Surface for the Roots to spread in. And since Mr. *Bradley* allows the Hill to contain two Perches to one of the Base, and the Soil of both to be of equal Goodness, and yet, affirms, that the two can produce no more of Grain or Trees, than the one Perch can; I cannot see, why it should not be as reasonable to say, That two Quarters of Oats will maintain a Horse no longer, nor better, than one Quarter of Oats, of equal Goodness, will do.

IN *Page* 13. He concludes thus: " That
" Hills, in their Measure, contain only as much
" profitable Land as the Plain or Plat of Ground
" they stand upon; and as a Proof of that, all
" *Vegetables* or *Plants* have an erect Method of
" Growth."

THIS Proof of Mr. *Bradley's* is founded upon an Argument which has no Consequence, unless it first proved, that the Surface of Earth could produce and maintain as many *Vegetables* or *Plants* as could stand thereon in an erect Posture ; which Supposition is as imposible, as that half an Acre should produce and maintain a Hecatomb, without Mr. *Bradley's* teaching Oxen to live upon Air for their Food, as he thinks *Van Helmont's* Tree did.

ALL expert Husbandmen must needs be convinced, that the greatest Crop of *Vegetables* that ever grew, might stand in an erect Posture, upon a twentieth (and I may say the hundredth) Part of the Surface that produced it ; therefore, there must be nineteen Parts (for the Roots to spread) unoccupied by the Trunks, Stems, or Stalks.

AND though it be true, that a Hill will support no more of these (than its Base) when placed in an erect Posture close together, as in a Sheaf ; yet, this close Position is only proper for them

them when they are dead, and require no more Nourishment than Houses and Pales do ; and consequently require no Room but to stand on. Therefore, this Argument of Mr. *Bradley's* must not be admitted in Vegetative Growth, where there is always required nineteen times more Room in the Surface, for the Use of the Roots, than what the Stems, Trunks, or Stalks, do possess upon it : And the more Room there is for the Roots, the greater Number of Plants may be produced.

NEITHER can I admit, that all *Vegetables* or *Plants* have an erect Method of Growth ; because the contrary is seen in Chamomile, and divers other *Vegetables*, which have an Horizontal Method of Growth.

BUT what is more material to this Purpose, to be observed, is, that all *Vegetables* have Horizontal Roots, and Roots parallel to the Earth's Surface or Superficies ; and unless those Roots have a sufficient Superficies of Earth to range in, for Nourishment of a Plant, the Stem and Branches cannot prosper, whatever be their Method of

Growth above the Earth; and if there be not a due Quantity of Food for the Roots, within the Earth, a very little Space may contain the external Parts of *Vegetables* upon it.

FROM what has been said, I think, we may conclude, That Mr. *Bradley's* Hill may produce more *Vegetables* than the Base whereon it stands; and therefore, it is of more Value than half its superficial Measure, *i. e.* Two Acres on the Hill is worth more than one Acre on the Plain, the Soil being equally rich, as he allows it to be, in his Case.

NOW, indeed, whether Mr. *Bradley* might not possibly be deceived in his Opinion, of the equal Richness of his Hill and his Plain, I will not dispute; I will only say this, that 'tis generally otherwise. But where a Plain is ploughed up into moderate *Ridges*, their Height being in Proportion to the Depth of the Staple, below which the Plough must take nothing into the *Ridges*, the Soil is equally rich, whether it be ploughed plain or ridged up. And as the Surface
is

is in the *Ridges* increased, there is nothing, in all Mr. *Bradley's* Arguments, that shews, why that increased Surface should not produce more *Vegetables* than the same Earth could do whilst it was level.

THERE are other Reasons why it should produce more when Ridged, besides the Increase of Surface; as,

I. 'TIS then more free from the Injuries of too much Water.

II. 'TIS better protected against cold Winds; because the Ridges are a Shelter to one another.

III. IF the Surface be much exhausted, by too frequent Sowing, the Ridges may be made just where the Furrows were, and then the Surface will be intirely changed.

THE following general Rules ought to be observed about *Ridges*, viz.

THAT

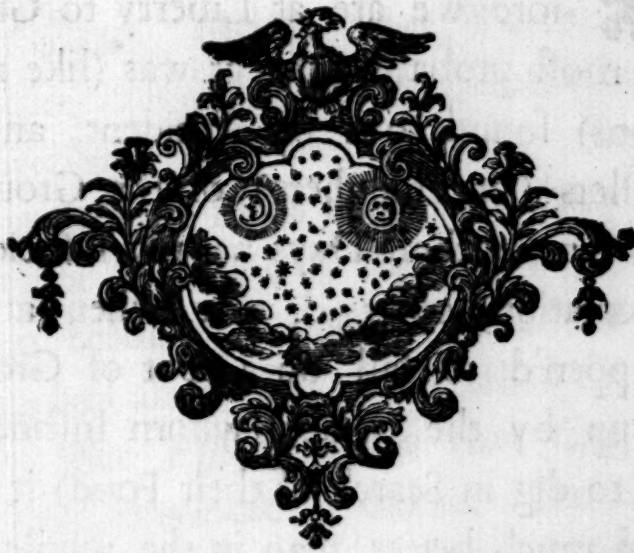
THAT as to their Height, Regard must be had to the Nature of the Soil, in its difficult Admission of Water; for the greater that is, the greater Declivities the *Ridges* should have; and then, if the Soil be not deep, they should generally be made the narrower.

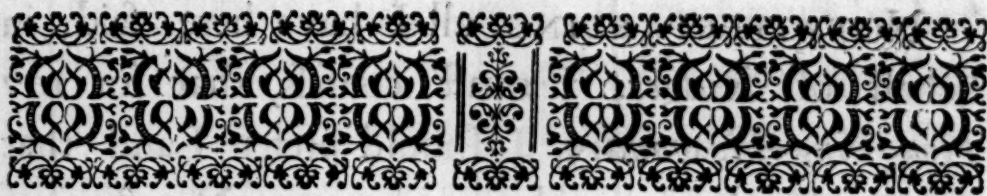
THERE is one Thing which Mr. *Bradley* takes no Notice of, *viz.* That no more of the Rain, or other Benefits of the Atmosphere, which descend perpendicularly, can fall on a Hill, or on a Ridge, than what would fall on the Base, or Ground Plot. But, 'tis probable, that more of the fine Vapour, which swims in the Current of the Air horizontally, does strike and break against those Eminences, and so make an Equivalent; * except that it runs off more quickly.

* But though *Ridges* do alter or increase the Surface, the Quantity of Soil or Earth remaining the same as on the Level, and of no greater Depth than can be Tilled, it may produce equal Crops of Corn with the Level, and no more; except from the Advantage the *Ridges* may give it in lying drier.

NOT-

NOTWITHSTANDING all I have here said, in behalf of *Ridges*, I must confess, that for my *Houghing-Husbandry*, I should prefer Land that is naturally dry enough, without a Necessity of being laid up in any larger or higher *Ridges* than what may contain six Feet in Breadth, that Size being the largest that is proper for the regular Operation of the *Horse-Hough*; whether the Rows be double, treble, or quadruple.





Of P L O U G H S.

 Y what Means *Tillage* it self came at first to be invented, is uncertain; therefore we are at Liberty to Guess: And it seems most probable, that it was (like most other Inventions) found out by Accident, and that the first Tillers (or Ploughers) of the Ground, were Hogs: Men in those Days having sufficient Leisure for Speculation, observ'd, that when any Sort of Seed happen'd to fall on a Spot of Ground well routed up by the Swine, (whom Instinct had instructed to dig in Search of their Food) it grew and prospered much better than in the whole unbroken Turf. This Observation must naturally induce rational Creatures to the Contrivance of some Instrument,

strument, which might imitate, if not excel Brutes in this Operation of breaking and dividing the Surface of the Earth, in order to increase and better its Product.

THAT some such Accident gave Men the first Hints of *Original Agriculture*, may be inferr'd from the very little (or no) Probability of its being invented originally upon Arguments which might convince the Understanding (by just Conclusions from Ideas of the Earth and Vegetation) of any reasonable Grounds to hope, that the Effect of increasing the Earth's Produce, should follow the *Cause of Tillage*; or, in other Words, Why it should produce more when Tilled, than when Untilled. Therefore, 'tis very unlikely that Men should *Begin* to take Pains to Till the Land, without any sort of Reason why they did it. And no such Reason could they have, before the Invention, as they had afterwards. For when they *Accidentally* saw that *Effect* follow that *Cause*, then they were well convinced it did so. But tho' this Argument, *viz. Tillage* increases the Product of the Earth, *because it does*, has been sufficient to

continue the Practice of *Tillage* ever since ; yet 'tis impossible for the Inventors to have had this Argument before the Invention, in Case it had been invented by Men, and not fortuitously discover'd.

HAD there ever been extant any other, or *Better Arguments* whereon this Practice, so useful to Mankind, was founded ; sure, some of all the Great and Learned Authors, who have writ on this Subjects, would have mention'd them. Philosophers, Orators, and Poets have treated of it in the same Theory by which it was first discover'd, and by no other, *viz.* Land produces more when Tilled ; and some seem to say, the more 'tis Tilled, the more it produces. It does, *because it does* ; not a Word of the Pasture of Plants, or any thing like it. So that all the ancient *Scriptores de Re Rusticâ* have done, was only to keep that Theory in the same Degree of Perfection in which the first Discoverers received it.

THE bristled Animals broke up the Ground, because they used to find their Food there by Digging ;

ging ; Men Till it, because they find *Tillage* procures them better Food than Acorns.

THE Reasons are the same for one and the other.

THESE Writers, ashamed to acknowledge so noble a Discovery to be owing to so mean a Foundation, make no Mention of the true Teachers, but attribute the Invention to *Ceres*, * a Goddess of their own making ; she, as they pretend, first taught the Art of *Tillage*. With this Fable they were so well pleased, that they never attempted to improve that Art, lest they should derogate from the Divinity of *Ceres*, in supposing her Invention imperfect.

* They did well indeed, to impute the Invention to a Woman ; because the Reasons whereon it was founded, were unbecoming of a Man : Being without Principles, it could not (likely) be improved, unless some Mathematical ones were discover'd.

They were very Unjust, to give the Reputation of Inventrix of *Tillage* to *Ceres*, who could be no better than a Plagiary, and make poor *Cicely*, from whose Family she stole it, fall a Sacrifice to her Altar, as the *Porca Pracidanea* did, amongst the *Romans*. But Swine had practised the Art of Turning the Soil, and so had Men, long before the fictitious Deity of *Ceres* was invented.

WITH what Instrument Men first Tilled the Ground, we don't know exactly ; but there may be Reasons to believe it was with the Spade, and probably a wooden one, and very rough.

FOR whilst People liv'd on Acorns, there was no Use of the Smith, such Food required no Knives for eating it, nor was it worth while to make Swords to fight for it ; and without Iron the Spade could not be well hewn, or shap'd ; but if it had been such as it is at present, there never was any thing comparable to it, for the true Use of *Tillage*. Yet the Spade could not make that Expedition, which was necessary when *Tillage* became general in the Fields ; and therefore in time the Spade came wholly to be appropriate to the most perfect Sort of *Tillage* in the Garden. Then the *Plough* supply'd the Place of the Spade in the Field ; and tho' it could not (such as it was) Till the Land near so well, yet it could Till ten-times more of it, and with less human Labour.

WHY

WHY they did not improve the *Plough*, so that it might also Till as well as the Spade, seems owing to their Primitive Theory, which gave no Mathematical Reason to shew wherein the true Method of *Tillage* did consist, viz. in dividing the Earth into many Parts, to increase its internal Superficies, which is the Pasture of Plants.

THE Difference betwixt the Operation of the Spade and that of the common *Plough*, is only this : that the former commonly divides the Soil into smaller Pieces, and goes deeper.

HOW easy and natural it is to contrive a *Plough* that may equal the Spade, if not exceed it, in going deeper, and cutting the Soil into smaller Pieces, than the Spade commonly does, I leave to the Judgment of those who have seen the Four-coulter'd *Plough*.

THE *Plough* describ'd by *Virgil* had no Coulter ; neither do I remember to have seen any Coulter in *Italy*, or the South of *France* ; and, as
I have

I have been inform'd, the *Ploughs* in *Greece*, and all the *East*, are of much the same Fashion; neither is it practicable to use a Coulter in such a *Plough*; because the Share does not cut the Bottom of the Furrow horizontally, but obliquely; in going one way, it turns off the Furrow to the Right Hand, but in coming back, it turns it to the Left; therefore, if it had a Coulter, it must have been on the wrong Side every other Furrow: And besides, as the Handle (for it has but one) always holds the *Plough* towards one Side, with the Bottom of the Share towards the unplough'd Land, it would cause the Coulter to go much too low when it went on the Furrow Side, and it would not touch the Ground, when it went on the Land Side.

'TIS a great Mistake in those, who say, *Virgil's Plough* had two Earth-Boards, for it had none at all; but the Share it self always going obliquely, serv'd instead of an Earth-Board, and the two Ears which were the Corners of a Piece of Wood lying under the Share, did the Office of Ground-Wrests:

This

This Fashion continues to this Day in those Countries, and in *Languedoc*.

THIS Sort of *Plough* performs tolerably when Ground is fine, and makes a shift to break up light Land; and I could never find any other Land there: I am sure, none comparable to ours for Strength; and it would be next to impossible, to break up such as we in *England* call *Strong Land*, with it.

I DO not find, that the Arable Lands about *Rome* are ever suffered to lie still long enough to come to a Turf; but I have observed in the low rich Lands in the *Calabria's*, subject to the Invasions of the *Turks*, that there is Turf, and that these *Ploughs* go over the Land two or three times before the Turf of it is all broken, tho' the Soil be a very mellow Sort of Garden-Mould. Having no Coulters to cut it, they break and tear the Turf into little Pieces. This was done in the Month of *November*; and had I not seen Men and Oxen at the Work, or had there been Oaks in the Place, I should rather have thought, that *Tillage* performed
by

by a Race of the first Teachers of it, in muzzling Acorns, than by *Ploughs*. However, the Mould being naturally very mellow, when the Turf is broken with shallow Ploughing, they can plough deeper afterwards.

THE *English Ploughs* are very different from the *Eastern*, as in general the Soil is.

THESE, when well made, cut off the Furrow at the Bottom horizontally; and therefore, it being as thick on the Land Side, as on the Furrow Side, the *Plough* cannot break it off from the whole Land, at such a Thickness (being six-times greater than the *Eastern Ploughs* have to break off), and must of Necessity have a Coulter to cut it off; by this Means the Furrow is turn'd perfectly whole, and no Part of the Turf of it broken; and if it lie long without new Turning, the Grass from the Edges will spread and form a new Turf (or Sward) on the other Side, which was the Bottom of the Furrow before Turning, but is now become the Surface of the Earth, and may soon become greener with Grass than before Ploughing; and often the
very

very Roots send up new Heads to help stock the reversed Furrow, the former Heads being converted into Roots, so that 'tis doubly cloathed and braced on both Sides, or, as it were, kay'd together, firm and solid, almost as a Plank; it may be drawn from one Side of a Field to the other, without breaking, and might possibly be made Use of, instead of *Virgil's Crates Viminea*, for harrowing or smoothing of fine Till'd Ground; but not without much Time, and Labour, and Difficulty can it be made such it self.

IF you plough whole strong turfy Furrows cross-ways, as *Virgil* directs, and as it is too commonly practised, the Coulter cannot easily cut them, because, being loose underneath, they do not make a sufficient Resistance or Pressure against its Edge, but move before it, and so are apt to be drawn and driven up into Heaps, with their Surfaces lying all manner of Ways, and situate in all manner of Postures: So the Turf, which is not turned, continuing in the open Air, grows on, and with its vigorous Roots, holds the Earth fast together, and will not suffer the necessary Division

to be made, which would be, if the Turf were rotten, and which is the End of all *Tillage*, viz. to increase the Pasture of Plants.

NEXT, some have vast heavy Drags, with great long Iron Tines in them; and though these huge broken Pieces of Furrows being looser than before, require keener Edges to cut them; yet these Drag-Tines have no Edge at all, but are as blunt as the Furrows they should cut. These Drags draw them sometimes into larger Heaps, leaving the *Under-Stratum* bare betwixt them, only shaking off some of their Mould in tumbling them about, and scratching their Surfaces, without reducing them to a moderate Fineness, until this ill-broken Land has, for above a Year, and sometimes longer, entertained Ploughs, Cattle, and Men, with a frequent laborious Exercise, for which they are obliged to the one Coulter. If the Soil be shallow, it may be broke up with a narrow Furrow, which will the sooner be brought in Tilth.

BUT

BUT if it be a deep Soil, the Furrows must be proportionably large, or else a Part of the good Mould must be left under unmoved, and so lost; for a *narrow* Furrow cannot be ploughed deep, because the *Plough* will continually slip out from the hard Land toward the Right-hand, unless the rising Furrow be of sufficient Weight to press the *Plough* towards the Left, and keep it in its Work: The deeper you plough, the greater Weight is required to press it; so that the deeper your Land is, the worse (or into the larger Furrows) must it be broke up with one Coulter, insomuch, that if the Land be strong, (as most deep Ground in *England* is) 'tis a Work of some Years to conquer it, after it has been rested. And often it happens, that the excessive Charge of this *Tillage* reduces the Profit of rich Land below that of much poorer.

THIS gives an Opportunity to deceitful Servants, of imposing upon their ignorant Masters. They plough such deep Land with a small shallow Furrow, to the End the Turf and Furrows

may be broken, and made fine the sooner; pretending they will plough it deeper the next time (which is called Stirring) which these Rogues know very well cannot be done, and intend no more than that, the *Plough* coming the easier after the Horses, their Coats may shine the better; and though there be no Crop at Harvest, they must have four Meals a Day, all the Year, and extravagant Wages at *Michaelmas*, or at any time of the Year, when they think fit to mis-behave themselves.

THIS Sort of Land must not be stirred, *i. e.* ploughed the second time in wet Weather, for that will cause the Grass and Weeds to multiply, besides the treading the Ground into hard Dabs, &c. And in dry Weather, the *Plough* will never enter any deeper than it went the first time, the Resistance below being so much more than the Pressure above, the *Plough* will rise up continually; or if it goes deep enough for the Weight of Earth to keep it down, another Inconvenience will follow, which is that mentioned by *Columella*, Page 47. *Quod omnis humus quamvis*

quamvis lætissima, tamen inferiorem partem jejuniorem habet, eamque attrahunt excitatæ majores Glebæ; quo evenit, ut infæcundior materia mista pinguiori segetem minus uberem reddat. The vulgar *English* Phrase is, It *Spaults* up from below the Staple. Hence the treacherous Ploughman is secure of an easy Summer's Work, if he can persuade his Master to suffer him to fallow the Ground with a shallow Furrow.

ANOTHER way to conquer a strong Turf, is, to plough it first with a *Breast-Plough*, very thin; and when the Sward is rotten, then plough it at the proper Depth: But this Method is (besides the extraordinary Charge of it) liable to other great Misfortunes. If the Turf be pared up in Winter, or early in the Spring, 'tis a Chance but the Rains cause it to grow stronger than before, instead of its Rotting.

AND if it be pared later, though dry Weather do follow, and continue long enough to kill the Turf, yet this loses Time, the Season of Ploughing is retarded, for all the Staple still remains untill'd,
and

and before that can be well done, the Year is too far spent for sowing it with Wheat, which is the most proper Grain for such strong Land, * and few will have Patience to wait, and plough on till another Wheat Seed Time. The dry Weather also, which in the Summer kills the Sward, renders the Ploughing obnoxious to most or all the Evils aforementioned.

A Farmer enquires concerning the *Four Coulter Plough*, as in the following *Dialogue*.

Farm. WHAT must we do then? Must we have Recourse to the Spade for breaking up our rich, strong, swardy Land?

Resp. IF you can procure Men to dig it faithfully in Pieces, not above two Inches and a half thick, at the Price of about eight Shillings *per* Acre, it would do very well, and answer all the Ends of *Tillage*; but though you bargain with them to dig it at that Size for three Pounds *per* Acre,

* Besides, most strong Land has Stones in it, which will not admit the Use of the *Breast-Plough*.

you

you will find, upon Examination, most of the Pieces or Spits, which are dug out of your Sight, to be of twice that Thickness. And no great Quantities can be this way managed, although the Price of Corn should answer such an extravagant Expence.

Farm. SINCE 'tis so difficult to bring our strong Land into Tilth, after it has rested, that it cannot be speedily done by a *Plough* without a Coulter, or by one with a Coulter, in wet Weather or dry, nor with a *Breast-Plough*, without a certain Expence, and an uncertain Success, the Spade is too chargeable a *Tillage* for the Field: It seems to me, upon the whole, that we are Losers by this *Inarata gratia Terræ*, unless we could contrive some other Method of reducing it sooner, and with less Charge, into Tilth; for, I observe, that when we sow it upon the Back, the Corn and Grass (or Couch) coming both together, exhaust the Ground so much, that by that time we can (which is about three Years) reduce the great Lumps to a tolerable Fineness, it grows full of
Grass

Grafs and Weeds (which we call Foul) and loses that Fertility we expected it should acquire by Rest, becoming, in our Terms, both out of Tilt and out of Heart.

Resp. IF you know all this to be true, and that, without a Coulter you cannot break it up at all; and that, with one Coulter you cannot any way cut the Furrow small enough, or less than ten Inches broad; why do not you cut it with four Coulters, which will reduce the same Furrow into four equal Parts, of two Inches and a half each in Breadth, and of the Depth of the Staple, though that should be two Spit, or sixteen Inches deep.

Farm. HOW can that be done?

Resp. EVERY Jot as easily as with one Coulter. For before the Furrow is rais'd by the Share, it lies fast, and makes a sufficient Resistance equally against the Edges of all the Coulters, though after it be rais'd and loose, it yields and recedes every way, except downwards, so that it cannot be cut
by

by any Edge, but such as attacks it perpendicularly from above, as that of the Spade does.

Farm. THIS seems, to me, reasonable, and having very lately heard Talk of this *Plough*, I would gladly know more of it.

Resp. THE Furrow being cut into four Parts, has not only four-times the Superficies on the eight Sides, which it would have had on two Sides; but it is also more divided cross-ways, *viz.* The Ground-wrist presses and breaks the lower (or Right-Hand) Quarter; the other three Quarters in rising and coming over the Earth-Board, must make a crooked Line about a Fourth longer than the strait one they made before moved; therefore, their Thinness not being able to hold them together, they are broken into many more Pieces, for want of Tenacity to extend to a longer Line, contrary to a whole Furrow, whose great Breadth enables it to stretch and extend from a shorter to a longer Line, without breaking, and as it is turn'd off, the Parts are drawn together again by the Spring of the Turf or

Q

Sword,

Sword, * and so remain whole after Ploughing. Thus the Four-coulter'd *Plough* can divide the Soil into above twenty times more Parts than the Common *Plough*; and sometimes when the Earth is of a right Temper betwixt wet and dry, the Earth-Board, in turning the Furrows off, will break them into Dust, having more Superficies than is made by four common Ploughings; and it is impossible there should be any large Pieces amongst it.

Now, What a prodigious Advantage must the Influences of the Atmosphere have upon these small Parts, for making a further Division of them? Frost, Water, Drought, and nitrous Air easily penetrate to their very Centers, which cannot in the largest of them be more than one Inch and a quarter distant from their Superficies. This Advantage, with a few subsequent common Ploughings perform'd in pro-

* A swardy Furrow cut off by only one Coulter, being whole, is apt to stand up on its Edge, or lie hollow, and then being open to the Air, it does not rot; but when it is cut by several Coulters, it has not Strength to support it self, it falls down, lies close to the Earth under it, and excluding the free Air from the Turf, it soon becomes rotten.

per.

per Seasons, resolves the Earth almost all to a Powder. The Swerd, some being immers'd or bury'd and mix'd among so great a Proportion of Mould, is soon rotten and lost, some of the Swerd lying loose a-top, the Earth presently drops out of it, and then the Roots are dry'd up, and die. Thus is the whole Staple of the Ground brought into perfect Tilt in a very short time beyond what the Spade ever does in such swerdy Land.

Farm. WHAT Sort of Weather is best for using this *Plough*?

Resp. ANY Weather, except the Ground be so dry and hard, that the *Plough* cannot enter it; but 'tis very proper to be done, when the Earth is so wet, that by no means it ought to be ploughed with any other *Plough*; for it never can be too moist for this, unless the Cattle which draw it, be mired: because, though all the Cattle should not go in the Furrow, yet their Treadings are cut so small by the Coulters, that the Earth is not kept from dissolving, as when turn'd off whole in common *Tillage*. 'Tis observ'd, that the Incisions

made by the Coulters on ſwerdy Land, will not heal or ſo cloſe up, but that they will open again by the next Ploughing, though it be a Twelve-month after. A Farmer who uſes this *Plough*, may Till in all Weathers and all Seaſons of the Year, either in Fallowing with this, which is beſt in wet, or in ſtirring with the common Ones, which muſt be done in dry Weather *; and when the Ground is broke up with this, it may be ſtirr'd in the drieſt Weather that can be, without the Danger of tearing (or ſpaulting) up of the *Under-Stratum* along with the Staple, becauſe this is all broken before, and then no more can riſe with it; as it does to the

* In this Way of Ploughing, there's no need to obſerve the critical Day of the Moon, nor whether ſhe be increaſing or decreaſing, neither what Wind blows, as *Virgil* ſo dogmatically enjoins to be preciſely obſerved; and ſome of the Ancients preſcribe the very Hour of the Day, beſides innumerable Degrees of wet and dry Weather, ſo that without all theſe Accidents meet, they tell us we muſt abſtain from Ploughing. Our Ploughmen would be glad their Maſters were as Superſtitious, for then the *Plough* might keep Holidays enough. But far from all this, we do not even obſerve at what time of the Sun's Courſe, we Till our Land in, and find it always ſucceeds beſt when the Soil can be broken into moſt Parts, without having any other Regard to Sun, Moon, Wind, or Weather; This *Plough* prevents the Injuries of them all.

Ruin

Ruin of the Soil, when in common *Tillage* they go deeper the second time than the first; also, if there be a Necessity of stirring some Sort of Land when 'tis wet, it ought either to be done with this *Plough*, or else with a common one drawn by a single Row of Cattle treading all in the Furrow; for though some Land be very fine, yet, when otherwise plough'd in wet Weather, it will be made into large Pieces by the Treading, and perhaps not dissolve again in a long time, therefore 'tis better to be prevented.

Farm. I perceive this *Plough* lays the Foundation for all good *Husbandry*; and there can be no other way to bring Land into perfect Tilth in so short a Time, or with so little Expence. And I am convinc'd, that no Farmer ought to be without it, who desires to be free from the Danger of his Land being ever out of Tilth; but I have heard it objected, that it is harder to draw than the common *Ploughs*: And that its Beam being longer, upon account of the four Coulters, it lies farther behind, and comes harder after the Horses.

Resp.

Resp. I MUST confess, there is something in that Objection; for that *Plough* being something longer, may be a little the harder Draught, and also its Weight and Strength must bear a Proportion to the Length of it. But this small Increase of the Draught would have been a much stronger (if not a fatal Objection, had that Custom been general, of Horses drawing by their Tails, as 'tis said to have been formerly in some Places; for then, perhaps, a sufficient Strength of Horses could not be apply'd to the *Plough*. But in Countries where Traces are in Use, every Horse of the Team may draw the *Plough* equally, and then there will be no other Inconvenience, besides the adding one Horse, or keeping a stronger Team: And he cannot be wise, who would lose the Profit of his Land, for the Odds of sometimes adding a Horse to his *Plough*. And I am very certain, that this *Plough* requires a much less Strength of Cattle to draw it, in the moist Weather, which is the most proper to use it in, than to draw a common *Plough* in the same Ground, and at the same Depth, in dry Weather; and can seldom be used safely in any other.

And

And the Vulgar, who have always a wrong Cause ready at Hand to apply to every thing, impute that Draught to the Fashion of the *Plough*, which ought to be imputed to its going deeper ; and this great Depth at which 'tis capable of Ploughing, viz. Two Spit deep is one extraordinary Benefit of it, though it may, on Occasion, go as shallow as any.

THE Draught is not so much increased by adding three Coulters, as may be imagined ; for when the Ground is moist, the Incisions are easily made by the Edges ; and when they are cut small, the Furrows rise much more easily upon the Share and Earth-Board, than if whole.

Farm. IF this *Plough* be so beneficial, having so many Advantages, and only the two Inconveniencies, one of requiring a little more Strength to draw it, and the other its being unfit for dry hard Ground, I wonder why it is not become more Common ?

Resp.

Resp. IT has been used with very great Success for these several Years last past, but never like to be Common, unless it be described in a more Geometrical Manner, than any *Plough* has hitherto been ; for the *Plough-wrights* find it difficult enough to make a common *Plough* with one Coulter to perform as it ought, for want of the necessary Rules of their Art. 'Tis upon this Account that the two-coulter'd *Ploughs* are used in few Places, though they have been found of excellent Use, and have been formerly Common : But, alas ! when the Makers, who by their diligent Study and much Practice had attained the Perfection of their Art, for want of learning to write their Rules mathematically, and shew how the mechanical Powers were applicable to them, the Art was in a manner lost, at the Death of those Artists ; and then the unskilful *Plough-wrights*, destitute of the true Rules, were not able to make a two-coulter'd *Plough* to perform well, and then it was left off. Very lately 'tis revived, since the three and four-coulter'd ones have been used ; from whence some have made a shift to take the Rules
of

of placing two Coulters into a *Plough*, and they begin to be common again ; and, no doubt, will cease again as soon as the Rules are forgot.

'TIS strange that no Author should have written fully of the Fabrick of *Ploughs* ! Men of greatest Learning have spent their Time in contriving Instruments to measure the Stars, and in finding out the Dimensions, and even Weight of the Planets : They think it more eligible to study the Art of Ploughing the Sea with Ships, than of Tilling the Land with *Ploughs* ; they bestow the utmost of their Skill, learnedly, to pervert the natural Use of all the Elements for Destruction of their own Species, by the *Bloody* Art of War. Some waste their whole Lives in studying how to arm Death with new Engines of Horror, and inventing an infinite Variety of Slaughter ; but think it beneath Men of Learning (who only are capable of doing it) to employ their learned Labours in the Invention of New (or even improving the Old) Instruments for increasng of Bread.

THE easiest Method of perpetuating the Use of the many-coulter'd *Ploughs*, and other newly-invented Instruments of *Husbandry*, is by Models, *i. e.* the Things themselves in Little, and these may be all portable even in a Man's Pocket : Every Part must be fully describ'd, with the true Dimensions, and the Mathematical Reasons on which their Contrivance is founded : Directions also for using them must be given at the same time that their Manner of Making is describ'd. In some, the very Horses which draw, must be represented, to shew the Manner of Fixing the Horses and the Traces : Cautions against all the Errors that may happen by the want of Experience in the Makers or Users, must be given.

WHEN this is done, and the Rules put into a Method, the *New Houghing Husbandry*, in all its Branches, will be much more easy and certain than the *Old* ; because there are no Mathematical Rules extant in any Method ; and a Man may practise the old random Husbandry all his Life, without attaining

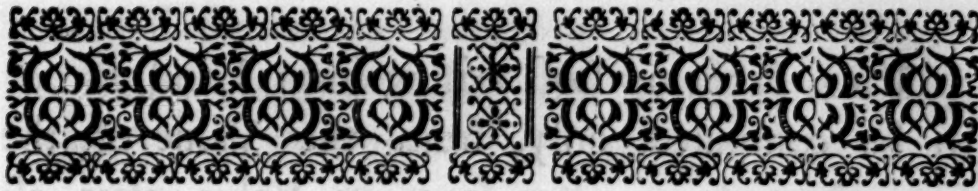
attaining so much Certainty in *Agriculture* as may be learn'd in a few Hours from such a Treatise.

THE Rules, indeed, require much Labour, Study, and Experience to compose them ; but when finish'd, will be most easy to practise : Like the Rules for measuring Timber ; their Use is, at first Sight, easy to every Carpenter, and to most Artificers who work in Wood, but no illiterate Person is able to compose those Rules, or to measure Timber without them.



be learned in a few Hours from such a Treatise.

But Timber without them.



O F

D I F F E R E N C E S

Between the

Old and the New Husbandry.

IN order to make a Comparison between the *Houghing Husbandry*, and the *Old Way*, there are four Things ; whereof the Differences ought to be very well considered.

I. *The Expence*

II. *The Goodness*

III. *The Certainty*

IV. *The Condition in which the Land is left after a Crop.*

} of a Crop.

THE

THE Profit or Loss arising from Land, is not to be computed, only, from the Value of the Crop it produces; but from its Value, after all Expences of Seed, Tillage, &c. are deducted.

THUS when an Acre brings a Crop worth *four Pounds*, and the Expences thereof amount to *five Pounds*, the Owner's Loss is *one Pound*; and when an Acre brings a Crop which yields *thirty Shillings*, and the Expence amount to no more than *ten Shillings*, the Owner receives *one Pound* clear Profit from this Acre's very small Crop, as the other loses *one Pound* by his greater Crop.

THE usual Expences of an Acre of Wheat, sown in the *Old Husbandry*, in the Country where I live, is, in some Places, for two Bushels and a half of Seed; in other Places four Bushels and a half, the least of these Quantities at *three Shillings per Bushel*, being the present Price, is *Seven Shillings and Six-pence*. For three Ploughings, Harrowing, and Sowing, *sixteen Shillings*; but if
plough'd

plough'd four times, which is better, *one Pound*. For thirty Load of Dung, to a Statute Acre, is *two Pounds five Shillings*. For Carriage of the Dung, according to the Distance, from *two Shillings* to *Six-pence* the Load; *one Shilling* being the Price most common, is *one Pound ten Shillings*. The Price for Weeding is very uncertain, it has sometimes cost *twelve Shillings*, sometimes *two Shillings per Acre*.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
In Seed and Tillage, nothing can be abated of ————	01	03	06
For the Weeding, one Year with another, is more than ————			
For the Rent of the Year's Fallow	00	10	00
For the Dung; 'tis in some Places a little cheaper, neither do they always lay on quite so much; therefore abating 15 s. in that Article, we may well set Dung and Carriage at ————	02	10	00
Reaping commonly 5 s. sometimes			
	00	04	06
Loss	04	10	00

FOLDING

FOLDING of Land with Sheep is reckoned abundantly cheaper than Cart-Dung; but this is to be questioned, because much Land must lie still for keeping a Flock (unless there be Downs) and for their whole Year's Keeping, with both Grass and Hay, there are but three Months of the twelve wherein the Field is of any considerable Value; this makes the Price of their Manure quadruple to what it would be, if equally good all the Year, like Cart-Dung: And Folding Sheep yield little Profit, besides their Dung, because the Wool of a Flock, except it be a large one, will scarce pay the Shepherd and the Shearers. But there is another Thing yet, which more inhances the Price of Sheep Dung, and that is the dunging the Land with their Bodies, when they all die of the Rot, which happens too frequently in many Places; and then the whole Crop of Corn must go to purchase another Flock, which may have the same Fate the ensuing Year, if the Summer prove wet: And so may the Farmer be served for several more successive Years, unless he should break, and another take his Place, or that dry Summers come in Time

to prevent it. To avoid this Misfortune he would be glad to purchase Cart-Dung at the highest Price, for supplying the Place of his Fold; but 'tis only near Cities and great Towns, that a sufficient Quantity can be procured.

BUT, supposing the Price of Dunging to be only *two Pounds ten Shillings*, and the general Expence of an Acre of Wheat, when sown, at *three Shillings per Bushel*, to be *four Pounds ten Shillings*, with the Year's Rent of the Fallow.

THE Expences of planting an Acre of Wheat in the *Houghing Husbandry*, is three Pecks * of Seed, at *three Shillings per Bushel*, is *two Shillings and Three-pence*. The whole Tillage, if done by Horses, would be *eight Shillings*; because our two Ploughing and six Houghings, † are equal to two

* Sometimes half a Bushel is the most just Quantity of Seed to drill on an Acre.

† But we sometimes plough our Six-Foot Ridges before Drilling, at five or six Furrows, which is a Furrow or two more than I have reckoned: But we do not always Hough six times afterwards.

Stirrings, the common Price whereof is *four Shillings* each; but this we diminish half, when done by Oxen kept on *St. Foin*, in this manner, *viz.* Land, worth *thirty Shillings* Rent, drill'd with *St. Foin*, will well maintain an Ox an Year,* and sometimes Hay will be left to pay for the Making; we cannot therefore allow more than *one Shilling* a Week for his Work, because his Keeping comes but to *Seven-pence* a Week round the Year.

IN plain Ploughing, six Foot contains eight Furrows; but we plough a Six-Foot Ridge at four Furrows, because in this there are two Furrows covered in the Middle of it, and one on each Side of it lies open. Now, what we call one Houghing, is only two Furrows of this Ridge, which is equal to a fourth Part of one plain Ploughing; so that the Houghing of four Acres requires an equal Number of Furrows with one Acre, that is plough'd

* Or an Ox may be well kept nine Months, with an Acre of indifferent *Horse-boughed* Turnips; and if we value them only at the Expence and Rent of the Land, this will be a yet cheaper Way of maintaining Oxen.

plain,

plain, and equal time to do it in (except that the Land that is kept in Houghing, works much easier than that which is not).

ALL the *Tillage* we ever bestow upon a Crop of Wheat that follows a houghed Crop, is equal to eight Houghings, two of which may require four Oxen each, one of them three Oxen, and the other five Houghings two Oxen each. However, allow three Oxen to each single Houghing, taking them all one with another, which is three Oxen more than it comes to in the whole.

BEGIN at five in the Morning; and in about six Hours you may hough three Acres, being equal in Furrows to three Rood, *i. e.* three Quarters of an Acre. Then turn the Oxen to Grass, and after resting, eating, and drinking two Hours and a half, with another Set of Oxen begin Houghing again; and by, or before half an Hour after Seven at Night, another like Quantity may be houghed. These are the Hours the Statute has appointed all Labourers to work, during the Summer Half-year.

TO hough these six Acres a Day, each Set of Oxen draw the Plough only eight Miles and a Quarter, which they may very well do in five Hours; and then the Holder and Driver will be at their Work of Ploughing ten Hours, and will have four Hours and a half to rest, &c.

THE Expence then of Houghing six Acres in a Day, in this manner, may be accounted; at *one Shilling* the Man that holds the Plough, *Six-pence* the Boy that drives the Plough, *one Shilling* for the six Oxen, and *Six-pence* for keeping the Tackle in Repair. The whole Sum for Houghing these six Acres is *three Shillings*, being *Six-pence per Acre*. * †

* But where there is not the Convenience of keeping Oxen, the Hiring Price of Houghing with Horses is one Shilling each Time.

† When a Roller is used, which is less than a Houghing, because one Person to lead is enough, and that may be a Boy; and once in an Interval may suffice, and then 'tis less Labour than half a Houghing; and for this we may well abate one Houghing of the eight.

THEY

THEY who follow the *Old Husbandry* cannot keep Oxen so cheap, because they can do nothing without the Fold, and Store-Sheep will spoil the *St. Foin*. They may almost as well keep Foxes and Geese together, as Store-Sheep and good *St. Foin*. Besides, the sowed *St. Foin* cost ten times as much the Planting as drill'd *St. Foin* does, and must be frequently manured, or else it will soon decay; especially upon all Sorts of chalky Land, whereon 'tis most commonly sown.

THE Expence of Drilling cannot be much, for as we can Hough six Acres a Day, at two Furrows on each Six-Foot Ridge, so may we drill twenty-four Acres a Day, with a Drill that plants two of those Ridges at once; and this we may reckon a *Penny Half-penny* an Acre.

I HAD five Acres of Wheat weeded this Year for *Six-pence*, being the second Crop: And the greatest Part of my drill'd Wheat wants no Weeding at all; every successive Crop being still more free from Weeds than the preceding Crop; therefore

fore I will set it all together at *Six-pence* * an Acre for Weeding.

FOR a Boy to follow the *Hough-Plough*, to uncover the young Wheat, when any Clods or Earth happen to fall on it, for which Trouble there is seldom occasion above once to a Crop, *Two-pence* an Acre. *One Penny* is too much for Brine and Lime for an Acre.

REAPING this Wheat is not worth above half as much as the Reaping of a sown Crop of equal Value; because the Drill'd standing upon about a sixth Part of the Ground, a Reaper may cut almost as much of the Row at one Stroke, as he could at six, if the same stood disperfed all over the Ground, as the Sowed does. And because he who reaps sowed Wheat, must reap the Weeds along with the Wheat; but the Drilled has no Weeds; and besides, there goes a greater Quantity of Straw, and more Sheaves, to a Bushel of the

* This is when the Land has been well cleansed of Weeds in the preceding Crop, or Fallow, or both.

sowed,

sowed, than of the drilled. And since some hundred Acres of drilled Wheat has been reaped at *two Shillings and Six-pence per Acre*, I will count that to be the Price.

The whole EXPENCE of an Acre of Drilled Wheat.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
For Seed —————	00	02	03
For Tillage —————	00	04	00
For Drilling —————	00	00	06
For Weeding —————	00	00	06
For Uncovering —————	00	00	02
For Brine and Lime —————	00	00	01
For Reaping —————	00	02	06
Total	00	10	00

The Expence of an Acre of Sow'd			
Wheat is —————	}	04	00 00
To which must be added, for the			
Year's Rent of the Fallow — —	}	00	10 00

Total 04 10 00

LE

IF I have reckon'd the Expence of the Drilled at the lowest Price, to bring it to an even Sum, I have also abated in the other more than the whole Expence of the Drilled amounts unto.

AND thus the Expence of a drilled Crop of Wheat is but the ninth Part of the Expence of a Crop sown in the common Manner.

'TIS also some Advantage, that less Stock is required where no Store-Sheep are used.

II. *Of the different Goodness of a Crop.*

THE Goodness of a Crop consists in the Quality of it, as well as the Quantity; and Wheat being the most useful Grain, a Crop of this is better than a Crop of any other Corn, and the hough'd Wheat has larger Ears (and a fuller Body) than sow'd Wheat. We can have more of it, because the same Land will produce it every Year, and even Land which, by the *Old Husbandry*,
would

would not be made to bear Wheat at all : So that in many Places, the *New Husbandry* can raise Ten Acres of Wheat for One that the *Old* can do ; because where Land is poor, they sow but a Tenth Part of it with Wheat.

WE do not pretend, that we have always greater Crops, or so great as some sown Crops are, especially if those mention'd by Mr. *Houghton*, be not mistaken.

THE greatest Produce I ever had from a single Yard in Length of a double Row, was Eighteen Ounces; the Partitions of this being Six Inches, and the Interval Thirty Inches, was, by Computation, Ten Quarters (or Forty Bushels) to an Acre.

I HAD also Twenty Ounces to a like Yard of a Third successive Crop of Wheat ; but this being a treble Row, and the Partitions and Interval being wider, and supposed to be in all Six Foot (though not quite so much) was computed to Six Quarters to an Acre. And if these Rows had been better order'd than they were, and the Earth more pul-

T

veriz'd,

veriz'd, more Stalks would have Tillered out, and more Ears would have attain'd their full Size, and have equal'd the best, which must have made a much greater Crop than either of these were.

BUT to compare the different Profit, we may proceed thus: The Rent and Expence of a drill'd Acre being *one Pound*, and of a sow'd Acre *five Pounds*; One Quarter of Corn produced by the Drill'd, bears an equal Proportion in Profit to the *one Pound*, as Five Quarters produced by the other do to the *five Pounds*. As suppose it be of Wheat, at *two Shillings and Six-pence* a Bushel, there is neither Gain nor Loss in the one nor the other Acre, though the former yield but One Quarter, and the other, Five; but if the drill'd Acre yield Two Quarters, and the sow'd Acre Four Quarters at the same Price, the drill'd brings the Farmer *one Pound* clear Profit, and the sown, by its Four Quarters, brings the other *one Pound* Loss. Likewise, Suppose the Drilling Farmer to have his *five Pounds* laid out on Five Acres of Wheat, and the other to have his *five Pounds* laid out on One dung'd Acre, then let the Wheat they produce

produce be at what Price it will, if the Five Acres have an equal Crop to the One Acre, then the Gain or Loss must be equal. But when Wheat is *Cheap*, as we say it is, when Sold at *Two and Six-pence* a Bushel, then if the *Virgilian* has Five Quarters on his Acre, he must sell it all to pay his Rent and Expence; but the other having Five Quarters on each of his Five Acres, the Crop of One of them will pay the Rent and Expence of all his Five Acres*, and he may keep the remaining Twenty Quarters, till he can sell them at *five Shillings* a Bushel, which amounts to *forty Pounds*, where-with he may be able to buy four of his five Acres at twenty Years Purchase, out of one Year's Crop, whilst the *Virgilian* Farmer must be content to have only his Labour for his Travel; or if he pretends to keep his Wheat till he sells it at *five Shillings* a

* Or suppose a drill'd Acre to produce no more than one Third of the sow'd Acre's Crop, whose Expence is five times as much as of the drill'd, 'tis much more profitable, because a Third of Five Pounds, is One Pound Thirteen and Four-pence; and a Fifth of the Rent and Expence being only One Pound, such drill'd Acre pays the Owner Thirteen Shillings and Four-pence more Profit than the other which brings a Crop treble to the drill'd.

Bushe], he commonly runs in Debt to his Neighbours, and in Arrear of his Rent; and if the Markets do not rise in time, or if his Crops fail in the Interim, his Landlord seizes on his Stock, and then he knows not how it may be sold, Actions are brought against him, the Bailiffs and Attornies pull him to Pieces; and then our *Virgilian* Farmer is broke *.

III. *The Certainty of a Crop.*

THE Certainty of a Crop is much to be regarded, it being better to be secure of a moderate Crop, than to have but a mere Hazard of a great one. The *Virgilian* is often deceiv'd in his Expectation, when his Crop at coming into Ear, is very big, as well as when 'tis in Danger of being too little. Our Houghing Farmer is much less liable to the Hazard of either of those Extreams; for when his Wheat is big, 'tis not apt to lodge or fall down,

* Tho' only five Acres and one Acre be put, yet we may imagine them Two hundred and fifty, and Fifty to enrich the one, or break the other Farmer.

which

which Accident is usually the utter Ruin of the other, he is free from the Causes which make the *Virgilian* Crop too little.

A VERY effectual Means to prevent the failing of a Crop of Wheat, is to plough the pulveriz'd Earth for Seed early, and when 'tis dry.

The early Season also is more likely to be dry than the latter Season is. The *Virgilian* is commonly late in his Sowing, because he can't

Fallow his Ground early, for fear of killing the Couch, and other Grass that maintains his folding Sheep, which are so necessary to his

Husbandry: And when 'tis sow'd late, it must not be sow'd dry, for then the Winter might kill the young Wheat. Neither can he at that

time plough dry, and sow wet, because he commonly sows under Furrow; that is, sows the Seed first, and ploughs it in as fast as 'tis

sown. If he sows early (as he may if he will) in light Land, he must not sow dry, for fear the Poppies and other Weeds should grow and devour his Crop; and if his Land be strong,

let it be sown early, wet or dry (tho' wet is worst).

worst) 'tis apt to grow so stale and hard by the Spring, that his Crop is in danger of Starving, unless the Land be very rich, or much dung'd, and then the Winter and Spring proving kind, it may not be in less danger of being so big as to fall down and be spoil'd. Another thing is, that though he had no other Impediment against ploughing dry, and sowing
6. wet, 'tis seldom that he has time to do it in ; for he must plough all his Ground, which is eight Furrows in six Foot, and whilst it is wet,
7. must lie still with his *Plough*. When he sows under Furrow, he fears to plough deep, lest he bury too much of his Seed, and if he ploughs
8. shallow, his Crop loses the Benefit of deep Ploughing, which is very great. When he sows upon Furrow (that is after 'tis plough'd) he
9. must harrow the Ground level to cover the Seed, and that exposes the Wheat the more to the cold Winds, and suffers the Snow to be blown off it, and the Water to lie longer on it ; all which are great Injuries to it.

OUR

OUR *Houghing Husbandry* is different in all of the foremention'd Particulars.

1. WE can plough the two Furrows whereon the next Crop is to stand, either before the present Crop is reap'd, or immediately after 'tis off.

2. WE have no use of the Fold; because our Ground has annually a Crop growing on it, and it must lie still a Year, if we would fold it, and that Crop would be lost; and all the Good the Fold could do to the Land, would be only to help to pulverize it for one single Crop; its Benefit not lasting to the second Year. And so we should be certain of losing one Crop for the very uncertain Hopes of procuring one the ensuing Year by the Fold; when 'tis manifest by the adjoining Crops, that we can have a much better Crop every Year, without a Fold on any other Manure.

3. WE can plough dry, and drill wet, without any manner of Inconvenience. He fears the Weeds will

will grow and destroy his Crop : We hope they
4. will grow, to the end we may destroy them.

5. WE do not fear to plant our Wheat early (so that we plough dry) because we can help the Hardness or Staleness of the Land by Houghing.

6. THE two Furrows of every Ridge whereon the Rows are to be drill'd, we plough dry ; and if the Weather prove wet, before these are all finish'd, we can plough the other two Furrows up to them, until it be dry enough to return to our Ploughing the first two Furrows, and after finishing them, let the Weather be wet or dry, we can plough the last two Furrows. We can plough our two Furrows in the fourth part of the Time they can plough their eight, which they must plough dry all of them, in every six Foot ; for they can't plough dry, when 'tis wet, as we can.

7. WE never plant our Seed under Furrow, but place it just at the Depth, which we judge most proper, and that is pretty shallow, about two Inches deep, and then there is no danger of burying it.

8. WE

8. WE not only plough a deep Furrow, but also plough to the Depth of two Furrows; that is, we Trench-plough where the Land will allow it; and we have the greatest Convenience imaginable for doing this, because there are two of our four Furrows always lying open; and two plough'd Furrows (that is one plough'd under another) are as much more advantageous for the nourishing a Crop, as two Bushels of Oats are better than one for nourishing a Horse. Or if the Staple of the Land be too thin or shallow, we can help it by raising the Ridges prepar'd for the Rows the higher above the Level.

9. WE also raise a high Ridge in the Middle of each Interval above the Wheat before Winter, to protect it from the cold Winds, and to prevent the Snow from being driven away by them. And the Furrows or Trenches, from whence the Earth of these Ridges is taken, serve to drain off the Water from the Wheat, so that it being dryer, it must be warmer than the harrow'd Wheat, which has nei-

ther Furrows to keep it dry, nor Ridges to shelter it, as every Row of ours has on both Sides of it.

IV. *The Condition in which the Land is left after a Crop.*

THE different Condition the Land is left in after a Crop, by the one and the other *Husbandry*, is not less considerable than the different Profit of the Crop.

A PIECE of eleven Acres of a poor thin chalky Hill, was sown with Barley in the common Manner, after a hough'd Crop of Wheat, and produced full five Quarters and a half to each Acre (reckoning the Tythe) which was much more than any Land in all the Neighbourhood yielded the same Year; tho' some of it be so rich, as that one Acre is worth three Acres of this Land: And no Man living can remember that ever this produced above half such a Crop before, even when the best of the common Management has been bestow'd upon it.

A FIELD

A FIELD that is a sort of a Heath Ground, us'd to bring such poor Crops of Corn, that heretofore the Parson carry'd away a whole Crop of Oats from it, believing it had been only his Tythe. The last Management that ever they did or could bestow upon it, was to let it rest two or three Years, and then fallow and dung it, and sow it with Wheat, next to that with Barley and Clover, and then let it rest again; but I cannot hear of any Crop that ever it produced by this or any other of their Methods; 'twas still reckon'd so poor, that nobody cared to rent it. They said Dung and Labour were thrown away upon it; then immediately after two Crops of black Oats had been taken off it, the last of which was scarce worth the Mowing, the Clover always look'd yellow, and so does the Grass that grows all round the Field.

THREE houghed Crops were taken from it, and then being sown with Barley, it brought a very good Crop, much better than ever it was known to yield before; and then a good Crop of houghed Wheat succeeded the Barley, being drilled

upon one plain Ploughing, immediately after the Barley was taken off; and then it was again sown with Barley, and upon the Wheat Stubble; and that also was better than the Barley used to be after a dung'd Crop of Wheat.

Now, all the Farmers of the Neighbourhood affirm, that it is impossible but that this must be very rich Ground, because they have seen it produce six Crops in six Years, without Dung or Fallows, and never a one of them fail. But, alas! this different Reputation they give to the Land, does not at all belong to it, but to the different Sorts of *Husbandry*; for the Nature of it cannot be alter'd but by that, the Crops being all carried off it, and nothing added to supply the Substance those Crops take from it, except (what Mr. *Evelyn* calls) the Cœlestial Influences, and that these are received by the Earth, in Proportion to the Degrees of its Pulveration.

A FIELD was Drilled with Barley after a houghed Crop, and another adjoining to it on the same Side of the same poor Hill, and exactly the same

same Sort of Land, was drilled with Barley also, Part of it after the sown Crop, the same Day with the other; there was only this Difference in the Soil, that the former of these had no manner of Compost on it for many Years before, and the latter was dunged the Year before, yet its Crop is not near so good as that which followed the houghed Crop; though the latter had twice the Ploughing that the former had before Drilling, and the same Houghings afterwards, *viz.* Each was houghed three times.

A FIELD of about seventeen Acres was Summer fallowed, and drilled with Wheat, and with the Houghing, brought a very good Crop (except Part of it, which being eaten by trespassing Sheep in the Winter, was somewhat blighted); the *Michaelmas* after that was taken off, the same Field was drilled again with Wheat, upon the Stubble of the former, and houghed but twice in all: This second Crop was a good one, scarce any in the Neighbourhood better. A Piece of Wheat adjoining to it, on the very same Sort of Land (except that this latter was always reckoned better, being

being thicker in Mould above the Chalk) sown at the same time on dung'd Fallows, and the Ground always dunged once in three Years, yet this Crop fail'd so much, as to be judged, by some Farmers, not to exceed the Tythe of the other : That the houghed Field has received no Dung or Manure for many Years past, it lying out of Reach for carrying of Cart-Dung, and no Fold being kept on my Farm : But I cannot say, I think, there was quite so much Odds betwixt this second undung'd houghed Crop and the sown ; yet this is certain, that the former is a good, and the latter a very bad Crop.

I COULD give many more Instances of the same Kind, where houghed Crops and sown Crops have succeeded better after houghed Crops than after sown Crops, and never yet have seen the contrary ; and therefore am convinced, that the Houghing (if it be duly performed, enriches the Soil more than Dung and Fallows, and leaves the Land in a much better Condition for a succeeding Crop ; the Reason I take to be very obvious. The artificial Pasture of Plants is made and increased by
Pulveration

Pulveration only; and nothing else there is in our Power to enrich our Ground, but to pulverize it, and keep it from being exhausted by *Vegetables*. * (Superinductions of Earth are an Addition of more Ground, or changing it, and is more properly Purchasing than Cultivating.)

THIS one Year's *Tillage*, which is but two Ploughings before Seed-time, commonly makes but little Dust, and that which it does make, has but a short time to lie exposed for Impregnation; and after the Wheat is sown, the Land lies unmoved for near twelve Months, all the while gradually losing its Pasture, by subsiding, and by being continually exhausted in feeding a treble Stock

* It may be asked, How 'tis possible that eight Houghings, which are but equal, in Labour, to two plain Ploughings, should so much exceed three plain Ploughings, as to procure as good or a better Crop without Manure, than the common three Ploughings can do with Manure, and enrich the Land also?

The Answer is, That each Houghing of the Five or Six being done to the Wheat Plants, though it does not clean plough the whole Interval underneath, yet it changeth the whole external Superficies (or Surface) thereof, whereby it becomes impregnate by the nitrous Air, as much as if it were all clean ploughed at the time of every Houghing, and the Weeds are as much stifled, or suffocated.

of Wheat Plants, and a Stock of Weeds, which are sometimes a greater Stock. This put the *Virgilians* upon a Necessity of using of Dung, which is, at least, but a poor *Succedaneum* of the Hough; for it depends chiefly on the Weather, and other Accidents, whether it may prove sufficient by Fermentation to pulverize in the Spring, or no: And, 'tis a Question whether it will equal two additional * Houghings, or but one; though, as I have computed it, one Dunging costs the Price of one hundred Houghings.

'Tis possible, perhaps, to pulverize the Ground with a Pen, and they seem to act almost as oddly, when, at such a vast Expence, instead of a Hough, they make Use of a T——, to help them in their Pulveration.

WHEN they have done all they can, the Pasture, they raise, is generally too little for the Stock that is to be maintained upon it, and much the

* *Additional*, because there must first be several Houghings to make our treble Row equal to an undunged Six-Foot Ridge of sown Wheat.

greatest Part of the Wheat Plants are starved; for from twenty Gallons of Seed they sow on an Acre, they receive commonly no more than twenty Bushels of Wheat in their Crop, which is but an Increase of eight Grains for one: Now, considering how many Grains there are in one good Ear, and how many Ears on one Plant, we find, that there is not one Plant in ten that lives till Harvest, even when there has not been Frost in the Winter sufficient to kill any of them; or if we count the Number of Plants that come up on a certain Measure of Ground, and count them again in the Spring, and likewise at Harvest, we shall be satisfied, that most, or all of the Plants that are missing, could die by no other Accident than want of Nourishment.

THEY are obliged to sow this great Quantity of Seed, to the End that the Wheat, by the great Number of Plants, may be the better able to contend with the Weeds; and yet, too often at Harvest, we see a great Crop of Weeds, and very little Wheat among them. Therefore, this Pasture being insufficient to maintain the present Crop,

without starving the greatest Part of its Plants, is likely to be less able to maintain a subsequent Crop, than that Pasture which is not so much exhausted.

WHEN their Crop of Wheat is much less than ours, their Vacancies (if computed all together) may be greater than those of our Partitions and Intervals; theirs, by being irregular, serve chiefly for the Protection of Weeds; for they cannot be ploughed out, without destroying the Corn, any more than Cannons Firing at a Breach, whereon both Sides are contending, can kill Enemies, and not Friends.

THEIR Plants stand on the Ground in a confused Manner, like a Rabble; ours like a disciplined Army; we make the most of our Ground; for we can, if we please, cleanse the Partitions with a Hand-Hough; * and for the rest, if the Soil be deep enough to be drilled on the Level, in treble Rows,

* Of all annual Weeds.

the Partitions at six Inches, † the Intervals five Foot; five Parts in six of the whole Field may be pulverized every Year, and at proper times all round the Year.

THE Partitions being one sixth Part for the Crop to stand on, and to be nourished by the Winter, one other sixth Part being well pulverized, may be sufficient to nourish it from thence till Harvest; the Remainder, being two Thirds of the whole, may be kept unexhausted, the one Third for one Year, and the other Third of it two Years, all kept open for the Reception of the Benefits descending from above, during so long a time; whilst the sowed Land is shut against them, every Summer, except the little time in which it is fallow'd, once in three Years, and a little, perhaps, whilst they plough it for the Barley in the Winter, which is a Season seldom proper for pulverizing the Ground.

† But when 'tis drilled upon Ridges, the Proportion is less by how much the Partitions being thicker in Mould, contain more than a sixth Part of the whole six Foot of Earth, and the Proportion of unexhausted Earth will be alter'd likewise; and I only mention these Distances to avoid Fractions.

THEIR Land must have been exhausted as well by those supernumerary Plants of Wheat, while they lived, as by those that remain for the Crop, and by the Weeds. Our Land must be much less exhausted, when it has never above one third Part of the Wheat-Plants to nourish that they have, and generally no Weeds; so that our houghed Land having much more Vegetable Pasture made, and continually renewed, to so much a less Stock of Plants, * must needs be left, by every Crop, in a much better Condition than theirs is left in by any one of their sown Crops, although our Crops of Corn at Harvest be better than theirs. †

THEY

* Therefore, whenever a Soil receives more Supplies of fine Earth from the Atmosphere, than is exhausted by all the Plants that grow in the Soil, it becomes richer; but if the contrary, then it becomes poorer.

† On an undung'd six Foot Ridge, we have three Rows, eight Inches asunder, all which being equal, during the Winter, but each of the two outside Rows at Harvest producing ten times as much Wheat as the middle Row doth, all three together produce a Quantity equal to one and twenty of this middle Row. Now, supposing the Roots of this Row not to reach through

THEY object against us, saying, That sometimes the Houghing makes Wheat too strong and gross, whereby it becomes the more liable to the Blacks (or Blight of Insects); but this is the Fault of the Hougher, for he may chuse whether he will make it too strong, because he may apply his Houghings at proper times only, and appportion the Nourishment to the Number and Bulk of his Plants. However, by this Objection they allow, that the Hough can give Nourishment enough, and

through the outside Rows, so as to receive any Benefit from the houghed Intervals, then this Row might only be equal to one of nine Rows, which should have been drilled eight Inches asunder on this Ridge, and then our three would only be equal to twenty one of such nine Rows. But since it can be demonstrated, that the Roots of our middle Row do pass through both the outside Rows far into the houghed Intervals, we may well suppose it to be at least double to what it would have been, if it had had no Benefit from the Houghing, and then our three will be equal to forty two of such nine unhoughed Rows. Thus our Crop is thirty three, in forty two (or almost four Parts in five) increased by the Houghing; for though many Fields of Wheat have been drilled all over in Rows eight Inches asunder, it never has been judged in twenty Years Experience, that a Crop so planted, though not houghed, was by its Evenness and Regularity, less, *Cæteris, Paribus*, than a Crop sown at random.

therefore

therefore they cannot maintain that there is a Necessity of Dung * in the *Houghing Husbandry*; and that, if our Crops of Wheat should happen to suffer by being too strong, our Loss will be less than theirs, when that is too strong, since it will cost them nine times our Expence to make it so.

A second Objection is, that as *Houghing* makes poor Land become rich enough to bear good Crops of Wheat for several Years successively, the same must needs make very good Land become too rich for Wheat. I answer, That if possibly it

* As for the Quantity of Vegetable Matter of Dung, when reduced to Earth by Putrifaction, it is very inconsiderable, and, of many Sorts of Manure, next to nothing.

The almost only Use of all Manure, is the same as of *Tillage*, viz. the Pulveration it makes by Fermentation, as *Tillage* doth by Attrition or Contusion; and with these Differences, that Dung, which is the most common Manure, is apt to increase Weeds, as *Tillage* (of which *Houghing* is chief) destroys them, and Manure is scanty in most Places, but *Tillage* may be had every where. Another Difference is, the vast Disproportion of the Price of Manure and that of *Tillage*.

Note, As we have no Way to enrich the Soil, but by Pulveration of Manure, or of Instruments, or of both; so Nature has ordain'd, that the Soil shall be exhausted by nothing, but by the Roots of Plants.

should

should so happen, there are two Remedies to be used in such a Case; the one is to plant it with Beans, or some other *Vegetables*, which cannot be over-nourished, as Turnips, Carrots, Cabbages, and such like, which are excellent Food for fattening of Cattle; or else they may make Use of the other infallible Remedy, when that rich Land, by producing Crops every Year in the *Houghing-Husbandry*, is grown too vigorous and resty, they may soon take down its Mettle, by Sowing it a few Years in their *Old Husbandry*, which will fill it again with a new Stock of Weeds, that will suck it out of Heart, and exhaust more of its Vigour, than the Dung, that helps to produce them, can restore.

THERE is a third Objection, and that is, that the Benefit of some Ground is lost where the *Hough-Plough* turns at each End of the Lands; but this cannot be much, if any, Damage; because, about two square Perch to a Statute Acre, is sufficient for this Purpose, and that, at the Rate of *ten Shillings* Rent, comes to but *Three-pence*, though this varies, according as the Piece is longer or shorter; and

and supposing the most to be eight Perch, that is but *Six-pence per Acre*; and that is not lost neither, for whether it be of natural or artificial Grass, the *Hough-Plough* in turning on it, will scratch it, and leave some Earth on it, which will enrich it so much, that it may be worth its Rent to Baiting of Horses or Oxen upon it. And besides, these Ends are commonly near Quick-Hedges or Trees, which do so exhaust it, that when no Cattle come there to manure it, 'tis not worth the Labour of Ploughing it.

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